

**ICT AS AN INSTRUCTIONAL TOOL FOR IN-SERVICE TEACHER
TRAINING: INFLUENCE ON CLASSROOM PRACTICE**

by

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UNIVERSITY OF PRETORIA

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Declaration

“I declare that the thesis, which I hereby submit for the degree Philosophiae Doctor at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.”

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Dedication

To Almighty God, the Pillar that holds my life!

To my husband, my chief cheerleader. Words would not be enough!

To my children, thank you darlings. We did it!

To my Mum. Your immense support is invaluable.

To my siblings. Blood is indeed thicker!

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Abstract

The rapid expansion of the knowledge society, due mainly to the ubiquity and access of ICT, places a demand on teachers to meet the challenges by acquiring the knowledge needed to make effective use of technology in the classroom. As key players in the education process to achieve transformed pedagogical practices, teachers must develop technological pedagogical skills to effectively integrate ICT into their teaching repertoire. In this regard, pre- and in-service training quality are crucial in preparing teachers for technology integration. This study explored the influence of ICT as an instruction tool on the classroom practice of in-service teachers, utilising a case study approach and Activity Theory principles as a theoretical lens. Qualitative methods were employed to capture data through interviews, observations, and document analysis. Data was analysed using content analysis to understand in-service teachers' constructions about learning through ICT and how it influenced their classroom practice. The investigation of the influence of ICT as an instructional tool for in-service teachers yielded unique patterns of their ICT learning-teaching experiences. The findings were threefold. First, the ICT learning experiences of the in-service teachers changed their perspective towards teaching and learning with ICT in their classrooms. This significant finding suggests that the in-service teachers developed technological pedagogical knowledge (TPK) as an unintended outcome of their learning experiences, transforming their classroom practice. Second, the teacher participants mirrored their lecturers' use of ICT in their classroom practices. This experience created affordances for the in-service teacher trainees to learn "how to teach pedagogically with ICT" rather than just "about ICT". Third, the in-service teachers displayed professional resilience to pursue the use of ICT and transform their practice in under-resourced and very constrained school conditions.

Keywords: ICT, teacher training, in-service teachers, pedagogy, mirroring, unintended

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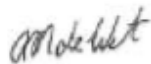
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List of Abbreviations

AT	Activity Theory
CAQDAS	Computer-Aided Qualitative Data Analysis Software
CHAT	Cultural Historical Activity Theory
CK	Content knowledge
COL	Commonwealth of Learning
DEO	District Education Offices
DIBL	Distance and Institutional Based Learning
DOS	Director of Studies
DTP	Distance Training Program
EMIS	Educational management information system
ESSP	Education Sector Strategic Plan
GoR	Government of Rwanda
HEC	Higher Education Council
ICEPS	International Conference on Education, Psychology, and Social Sciences
ICT	Information and Communication Technology
ICTs	Information and Communication Technologies
ITA	Internet Technologies and Applications
KIE	Kigali Institute of Education
LINC	Learning International Networks Consortium
LMS	Learning management system
MIS	Management information system
NCE	National certificate in education
NTI	National Teachers Institute
PD	Professional development
PDF	Portable Document Format
PEOU	Perceived ease of use

PGCE	Post graduate certificate in education
PGDIL	Process Guidance Inquiry Learning
PK	Pedagogical knowledge
PU	Perceived usefulness
REB	Rwanda Education Board
SAMR	Substitute, Augmentation, Modification, and Redefinition
TAM	Technology Acceptance Model
TCK	Technological content knowledge
TK	Technological knowledge
TPACK	Technology Pedagogy and Content Knowledge
TPK	Technological pedagogical knowledge
TTC	Teacher Training College
UNISA	University of South Africa
ZINTEC	Zimbabwe Integrated Teacher Education Course

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1 CHAPTER ONE

ORIENTATION TO THE STUDY

1.1 Introduction

Technology has permeated all spheres of human endeavour; there is hardly any human activity that has been unaffected by the advent of new discoveries in technology. A cursory look at our society today clearly reflects the permeation of information and communication technology (ICT) into all sectors of the economy. Information and communication technology plays a vital role in the development of any nation and has been instrumental to achieving social, economic, educational, scientific and technological development (Adedeji, 2010). Information and communications technology has influenced all sectors of society, from banking to health care, agriculture, communication, and education, just to mention a few. ICT has changed how humans go about their daily activities, and life is not what it used to be. Governments worldwide have adopted various rationales (Hawkrige, 1990), including technology, as the highway for knowledge transfer to respond to rapid technological advancement and globalisation. Therefore formulation and review of new and existing policies to accommodate the use of ICT in all areas of the economy (Ghavifekr & Rosdy, 2015; Tan, Koh, Chan, Costes-Onishi, & Hung, 2017) becomes critical.

The changes brought about by ICT have translated into a total transformation of the 21st century workplace, which now demands a generation of seasoned computer users as employees. Preparing learners for the digital era hinges on teachers as the key players and change agents (Tan, Choo, Kang, & Liem, 2017). Hence, the responsibility of preparing learners for the 21st century workplace falls mostly on the school and specifically, the teachers. Teachers are tasked with creating learning environments that would stimulate creativity and innovation in their learners and instil survival skills for the future workplace. The most commonly cited reason for using ICT in the classroom is to prepare learners for the ubiquity of technology in the digital age (Sylvestre et al., 2018).

Therefore, teachers are central to all discourse concerning the appropriateness of their pedagogical skills and competences in meeting the learners' needs in their classrooms. Unarguably, teachers need to possess the right pedagogical skills, competence and mindset

to meet both the expectations of their learners and that of the curriculum (Bhattacharjee & Deb, 2016).

Ensuring that teachers are pedagogically equipped with the best skills and competences becomes the responsibility of teacher training institutions. The integration of ICT into teacher training serves as an avenue to expose and familiarise trainees with the pedagogical values of ICT tools and their usefulness within the classroom context. Teacher trainees need to experience the same learning environments they are expected to create in their classrooms. It is crucial to have well-designed teacher training programmes to support today's teachers learning with and about ICT. In other words, teacher educators need to effectively and adequately model the type of competencies and skills that pre-service teachers require for success and survival in their future classrooms. Research has pointed out that training goals should be directed towards developing the ICT pedagogical competencies of trainees to achieve the desired transformation in the classroom (Tondeur et al., 2018; Tondeur et al., 2012).

A critical look at the education landscape in developing countries, especially in Africa, reveals that not many teachers possess the skills and competences required to prepare learners for the 21st century workplace (Msila, 2015; Munyengabe et al., 2017). The reasons for this range from a teacher shortage, lack of relevant qualifications, lack of ICT skills, and non-accessibility of ICT tools to the lack of in-service professional development opportunities. In the Rwandan context, many teachers lack the minimum qualification requirement stipulated by the education authorities (Paul et al., 2013). Hence, it is essential to introduce training programmes that allow teachers to further their professional qualifications while working. Distance education with different study modes was introduced across the country to reach the widely dispersed population of underqualified¹ and unqualified² teachers around the country. This approach is aimed at assisting teachers to develop the competencies needed to function effectively in the classroom.

Accordingly, this study investigated how information communication technology as an instructional tool for in-service teachers influences classroom practice. The present study

¹ Underqualified teachers are teachers who only have diplomas from teacher training colleges

² Unqualified teachers are teachers without any teaching certification

inquired into the experiences of in-service teachers as they advanced their professional qualifications in an ICT-enriched context to explore if it translated into changed classroom pedagogy.

This chapter provides an overview of the current research. This chapter is divided into several subsections, including the introduction and context, problem statement, research questions, and justification for the study. This chapter also provides an overview of the two paradigmatic lenses that guided this research, the existing literature assumptions, and the theoretical framework underlying this study. In addition, the research design and methodology are briefly described. This chapter concludes with an overview of the subsequent chapters of this investigation.

1.2 Background context

Teachers are expected to serve as agents of change. Constantly confronted with new obstacles, one of which is making education global, permanent, and adaptable enough to serve in any environment for life. Rubagiza et al. (2011) argue that without a shift in the pedagogical practices of teaching and learning, particularly with regard to ICT in schools, the future generation of Rwanda is unlikely to learn how to exploit the affordances offered by access to ICT.

After the genocide in 1994, Rwanda faced a staffing shortage in all sectors of the economy. The education sector was the most affected as the lives of many teachers were lost, and the entire education system became dysfunctional. Rwanda inherited a legacy of a high proportion of unqualified teachers and an acute teacher shortage. The Rwandan Ministry of Education (MINEDUC) published a report in 1999 revealing that more than sixty-five per cent of teachers in Rwanda were unqualified (MINEDUC, 1999). Therefore, training teachers through a distance education mode became an important means of solving the dire lack of qualified teachers in Rwanda. In 2002, MINEDUC revised the education sector policy, stating that “Teachers at all levels shall be trained in sufficient number and quality, both pre-service and in-service teacher training methods with the use of distance education shall be strengthened”. This policy mandate led MINEDUC to use distance education to upgrade the qualification of teachers (Owens, Hardcastle, & Richardson, 2009).

Enhancing teacher capabilities in and through ICT is one of the strategies used by the Rwandan government to develop high-quality skills and a knowledge base, leveraging ICT throughout the country's socioeconomic sectors. The purpose of ICT in education policy is to direct the process of harnessing, deploying, and exploiting ICT within the education sector to support its organizational activities and operations within the context of the national ICT-led development vision. (MINEDUC, 2016).

The Rwandan “Vision 2020” policy (MINECOFIN, 2012) aimed to transform the country into a knowledge-based, technology-led and middle-income society by 2020. Just like many other countries whose economies are in transition, Rwanda has initiated purposeful education reforms intended to remodel their education systems to respond better to the needs of new economic realities (Sahlberg & Boce, 2010). Information and communication technology is considered the primary universal tool that will energize the country’s socio-economic development. ICT was placed at the heart of transforming all sectors of the core socio-economic pillars. ICT in education is one of ‘*the*’ core pillars of the country’s National Information and Communications Infrastructure Policy and Plan (NICI), which was adopted in 2000.

In Rwanda, the ICT in Education Policy (MINEDUC, 2016) adoption was followed by sub-plans that were progressively updated and revised since 2000, culminating in implementation strategies emphasizing the need for ICT training for primary and secondary school teachers. The policy also highlighted the development of e-learning content and educational management information system (EMIS), the provision of computers and the internet in schools, and the fast move into purchasing and installing ICTs in higher education institutions (HEIs), among many others (Farrell, 2007).

- **A brief overview of distance teacher education in Rwanda**

One of the initiatives of distance teacher education in Rwanda, known as the Distance Training Program (DTP), translated in Kinyarwanda³ as “IYAKURE” literally meaning “offered from a distance”. Through a collaboration with the Ministry of Education, the DTP was introduced in Rwanda in 2001 through the former Kigali⁴ Institute of Education

³ Kinyarwanda is the mother tongue and one of the official languages in Rwanda

⁴ Kigali is the capital city of Rwanda.

(KIE). The aim was to upgrade in-service secondary school teachers' professional skills and mitigate the shortage of teachers (Mukamusoni, 2006). The programme was initiated in the aftermath of the genocide against the Tutsis⁵ in 1994, affecting all sectors of the Rwandan economy. In-service teachers in the DTP programme received support from a network of part-time subject tutors in various study centres. All regional centres have a DTP coordinator who manages the distribution of modules and takes stock of resources such as reference textbooks, laboratories, and computer laboratories. Twice a year, in-service teachers (students) attend residential (face-to-face) training sessions during school holidays, and twice a month, they attend alternating weekend tutorials. It is in these research site contexts the present study is situated.

The initial training of teachers could accommodate either pre-service or in-service teachers (Perraton, 2010). Pre-service teachers requiring initial training have had no training before being employed as teachers in a school. On the other hand, In-service teachers requiring initial training are already employed as teachers but have never had any formal training. The continuing professional development of teachers can be categorised into teachers who already have a teaching qualification but need upgrading, and teachers who need reorientation education due to curriculum change, and teachers' career development (Fyle, 2013).

Horeb University Rwanda (pseudonym) offers a similar programme to in-service teachers known as Distance and Institutional Based Learning (DIBL), also known as School-Based in other institutions. Students meet each school vacation for face-to-face sessions offering interaction with instructors and for examinations. The DIBL programme employs a blended learning approach for teaching and learning, where students continue to study through a learning management system (LMS) after leaving for their various school destinations at the end of each contact session. The participants of this study are situated in this bounded case study context.

⁵ Tutsi is an ethnic group in Rwanda.

1.3 Rationale for this study

In the course of my service to Horeb university as an assistant lecturer and the coordinator for teaching practice in the Department of Education, I engaged significantly with in-service teachers (students) on different levels on issues that concerned teaching practice registration, supervision, and assessment. I visited several schools to supervise students while they participated in the compulsory three-month teaching practice, commonly referred to as work-integrated learning. During the periodic assessment visits to different schools, I observed that many in-service teachers did not incorporate ICT into their teaching and that their teaching can be boring and traditional. Their lessons were abstract and non-engaging for the learners in their classrooms. This experience provoked an academic puzzle in me about the phenomenon of whether learning in an ICT-enriched university environment influences the classroom practice of in-service teachers.

The effective use of ICT in education compared to other sectors of the economy worldwide is less pronounced (Lim et al., 2013; Schrum et al., 2005). Mukuna (2013) posited that the failure of teacher education institutions to assume a leadership role in achieving pedagogical transformation might lead to the education sector being left out in the spiralling wave of technological change. Hence, the onus is on teacher training institutions and programmes, especially in developing countries, to innovate and model new tools and pedagogies for teaching and learning to teacher trainees.

My intrinsic professional interest thus prompted me to explore how students experience the ICT-enriched learning environment and how these experiences shape their classroom practice as in-service teachers. Furthermore, I wanted to find if there was any influence on what they learnt as students and how this translated to their classroom practices as teachers. Hence, I chose to investigate these two contexts. Furthermore, while literature abounds on pre-service teachers' experiences, there is a dearth of literature on how in-service teachers experience ICT for learning, particularly in an ICT-enriched context. This investigation aims to fill the existing research knowledge gap.

1.4 Statement of the research problem

Hawkrige (1990) identifies four rationales why governments would want to introduce information and communication technology to a country context. One of the rationales was pedagogy enhancement (Hawkrige, 1990); hoping that ICT would transform education and in particular teaching and learning. However, three decades later, this aim of transforming the educational practices of teachers has been marginal (Vandeyar, 2021) and has not been achieved in the wider teaching community. The key to understanding technology use for teaching and learning is to investigate the most significant factor: the teacher. The advent of ICT as an innovation in teaching, places teachers in a critical position of importance regarding their role in the teaching-learning situation more than ever before (Vandeyar, 2020b, 2021). In other words, bringing ICT into schools has implications for teachers' pedagogical practice; it requires the development of a new set of pedagogical skills, methodologies, and abilities to interpret and deliver the curriculum using ICT.

In the past two decades, narratives in education concerning the use of technology for teaching and learning have evolved through various stages. The first phase involved arguments around access, skills, and availability of infrastructure to integrate ICT successfully into teaching and learning (Buabeng-Andoh, 2012; Mathevula & Uwizeyimana, 2014; Rastogi & Malhotra, 2013). The second phase saw arguments, debates and narratives on the acceptance and adoption of ICT for teaching and learning in the classroom (Buabeng-Andoh, 2012b; Chigona et al., 2010; Mirzajani et al., 2016). The third phase's research activities focused on the pedagogical values of these ICTs in the classroom (Cassim, 2010; Hennessy et al., 2010; Singh & Chan, 2014). Empirical evidence has shown that ICT has the potential to serve as a catalyst for new pedagogical approaches in teaching and learning.

The present debate in the field seems to be the lack of evidence of teachers' changed pedagogy in the classroom. Teachers have not been able to maximise the potentials of ICT in the classroom beyond using them to support and promote traditional ways of teaching. Therefore, the question remains "why has teacher pedagogy not changed as expected?" Researchers have tried to answer this question by exploring teacher perspectives regarding

skills, conceptions, attitudes, and perceptions towards ICT. However, despite these efforts, no clear consensus has been reached on why pedagogy has not changed.

According to Combrinck et al. (2015), ICT integration in teaching refers to implementing and using various kinds of technology, including the internet, to transmit knowledge to students. I am certain that the COVID-19 pandemic has entrenched the notion that technology is here to stay, especially in education. In schools, ICT is justifiably reshaping teaching and learning activities. In Rwanda, several initiatives to promote the use of ICT in education have been put in place. The Government of Rwanda (GoR) has implemented numerous ICT initiatives, notably ICT training for teachers and the One Laptop per Child (GoR, 2015). ICT has been integrated into the teacher training curriculum, and computers have been provided in the classrooms (GoR, 2015).

However, these initiatives have not changed how ICT is used in Rwandan classrooms (Ndayambaje & Ngendahayo, 2014). Accordingly, this study seeks to contribute to the knowledge gap (Miles, 2017; Müller-Bloch & Kranz, 2015) by investigating how ICT as an instructional tool for in-service teacher training influences classroom practices, especially within a developing country context.

1.5 Research Question

Main research question

This study is guided by the following main research question:

- How does ICT as an instructional tool for in-service teachers influence their classroom practice?

Research sub-questions

In support of the main research question, I proposed two sub-questions:

- What are the in-service teachers' learning experiences in an ICT-enriched teacher-training context?
- How does learning through ICT translate into changed classroom practice?

1.6 Locating myself within the study

A significant part of the researcher's role is ensuring reflexivity in their study to prevent bias in conducting the research (Starfield, 2013). I engaged in reflexive reporting by informing the readers of my actions through the researcher journal of my actions, interests,

and experiences to bracket my bias (Berger, 2015; Dodgson, 2019; Haynes, 2012). Haynes (2012) described reflexivity as the awareness of the researcher's role in conducting research, and it allows the researcher to acknowledge the way both the process and the outcome of the research can be affected by them. I understood well what was expected of me as a researcher (Berger, 2015), and I was careful to tell the study participants' story and not my own. Similarly, I understood that I played a double role in the investigation, a researcher as well as a learner (Glesne, 2016).

The fact that I shared certain experiences with my participants within the scope of the research objectives potentially increased the significance to the data. However, I was able to mitigate this effect through bracketing. I carefully avoided any form of bias through bracketing my feelings, opinions and subjectivity (Bednall, 2006). I was careful to separate my pre-conceived views as a lecturer on how employing ICT for teaching in-service teachers could influence their classroom practice. This allowed me to reflect critically on the entire research procedure and findings.

1.7 Paradigmatic perspectives

The researcher must assume a philosophical position concerning the phenomenon to be studied and operate within a particular paradigm. The paradigmatic approaches of researchers differ due to the different ways individuals view their world. Therefore, the researchers' worldview dictates the selection of an appropriate strategy to observe and interpret the phenomenon under study. In the following sub-section, I discuss my meta-theoretical paradigm (my worldview), which influenced my methodological paradigm (research methods).

1.7.1 *Meta-theoretical paradigm*

Constructivism facilitates the understanding of the complex and multiple nature of phenomena (Adom & Ankrah, 2016). Similarly, it contributes to comprehending the human condition in different contexts (Bengtsson, 2016). Within the constructivist paradigm, I acknowledge and embrace the understanding that an inherent subjectivity is involved when working with human beings. Therefore, as a researcher, the onus is on me to explore the subjective conceptualisations of reality that teachers in a particular social

context have constructed by engaging in the “lived experiences” of the participants of this study (Lincoln et al., 2011, p. 106).

1.7.2 *Methodological paradigm*

My worldview as a constructivist researcher construes my methodological lens as a qualitative inquirer. This study collected data within a natural setting (Silverman, 2020). The selection of the methodological paradigm hinged on the philosophical assumption that a phenomenon is best understood when it is studied in its natural environment. I deemed this approach appropriate for my study because I was interested in exploring my participants' lived experiences to understand how their learning experiences as students influence their classroom practice as teachers (Creswell & Poth, 2017).

1.7.3 *Case study strategy of inquiry*

A case study is a research strategy that allows researchers to study their subjects intimately from varied angles to understand the “how” and “why” surrounding a particular phenomenon (Thomas, 2021). A case study is defined by the researcher's interest in an individual case rather than the methods of inquiry employed. Case studies focus on the case's experiential knowledge and its influence on its various contexts (Stake, 2008). I deemed a qualitative instrumental case study fit for this investigation because I was interested in how in-service teachers and their ICT learning experiences at a university in Rwanda might influence their classroom practice. Cognisant of the type of research questions posed in the present investigation, and the exploratory stance that I adopted, I found the case study approach most suitable for my study, because it possessed the ability to thoroughly elucidate the unique experiences, perceptions, and beliefs of different actors in a real-life situation.

When researchers find it difficult to separate the variables of a phenomenon from its setting, they rely on a case study approach as the more appropriate strategy (R. K. Yin, 2012). The case study approach allows a phenomenon to be explored within its context by employing varied sources of data (Creswell & Creswell, 2017). In this study, different data sources were collected to facilitate the exploration of a phenomenon from various angles, thereby revealing its multiple facets.

1.8 Theoretical Framework: Activity Theory

This study is underpinned by the Activity Theory developed by Engeström (1999). The rigour of activity theory is that it enables an understanding of learning as the complex result of tool-mediated interactions rather than as something blurred in the learner's mind. Activities govern human lives; through activities, humans develop skills, identities, personalities and consciousness. Furthermore, activities facilitate the transformation of social conditions and help to create new forms of self and life (Engeström, 2009). Activity theory helps to make sense of the actions of participants within an activity system and the impact such actions may have on the participants in different contexts. In the present study, activity theory helped understand how the in-service teachers engaged in different learning activities while interacting with ICT tools as mediating artefacts in a university environment, and how their learning experiences shaped their classroom practice in different contexts.

Activity theory is defined as a set of principles and a robust framework for analysing professional practice; it offers a multi-dimensional and systemic approach to analyse complex and evolving professional practice. Activity theory hinges on three significant tenets: First, humans collaborate, learn by doing, and communicate through their actions; second that humans employ and adapt tools to learn and communicate; and third, a community is central to the process of making and interpreting meaning (Vygotsky, 1978). Activity theory, therefore, offers a strong paradigm for exploring the experiences of the in-service teachers as mediated by tools and how the communities in both contexts (learning and teaching) played out in the process of making meaning of their learning and classroom practice.

1.9 Research Assumptions

Based on the literature, I formulated some research assumptions (Simon, 2011) that are relevant to this study.

- **Assumption 1**

Teacher education programmes need to help teachers to develop knowledge of good pedagogical practices, technical skills, and content knowledge (Koehler & Mishra, 2009).

- **Assumption 2**

A shift in teachers' perception of change, their role in change processes, and an openness to change are prerequisites for achieving transformation in their practices (Ling & MacKenzie, 2001).

- **Assumption 3**

Teachers' interest in the learning domains of subject content and subject-specific pedagogies increases towards mid-career (Louws et al., 2017).

- **Assumption 4**

Teacher training programmes do not focus on the pedagogical practices concerning ICT but on the development of ICT skills alone (Bingimlas, 2009; Kalogiannakis, 2010)

- **Assumption 5**

Well-designed professional development programmes utilising modelling approaches promote teacher learning (Darling-Hammond et al., 2017).

- **Assumption 6**

When learning experiences are focused solely on technology, with no specific connections to content and learning goals, teachers are unlikely to incorporate technology into their practices (Ertmer & Ottenbreit-Leftwich, 2010).

These research assumptions are revisited in chapter six.

1.10 Research design and methodology

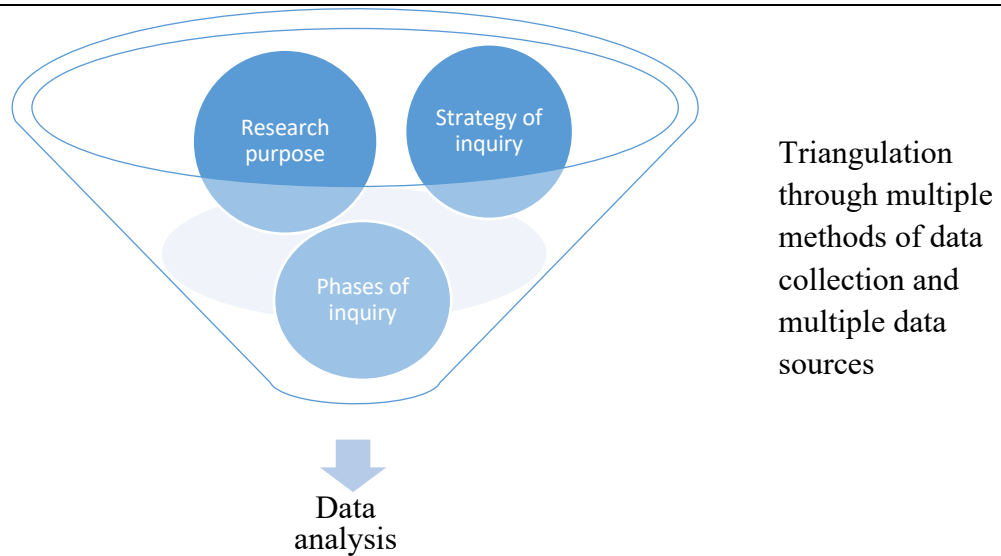
Creswell (2008) describes research design as the plan to conduct research that entails the intersection of philosophy, inquiry strategies and methods. Research designs are plans and procedures that cover decisions from general assumptions to detailed data collection and analysis methods. The design of a research endeavour demands that the enquirer makes decisions concerning the research problems and questions, participant sampling and data gathering and analysis. A more comprehensive discussion of the research design and methodology is presented in Chapter 3 of this thesis. Figure 1.1 summarises the research design, inquiry strategy and data collection methods employed in the study.

1.10.1 *The research process and phases of inquiry*

An exploratory qualitative design aligned with a constructivist methodology was used in this study. The cases in this study were defined and bounded (Yazan, 2015) by their peculiarity to the in-service teachers' learning experiences at a HEI and their classroom practice in various schools where they were employed. I obtained the experiences of the in-service teachers through an intrinsic case study (Stake, 2008, 2010; Starman, 2013). I purposefully selected a higher institution of education that was adequately equipped with ICT facilities and tools. Similarly, the purposeful selection of the in-service teacher participants (n=8) who were employed in different schools and were also students at the HEI was done through defined criteria. The justification for the purposeful selection of site and participants was underpinned by the optimum goal of obtaining cases that are capable of providing data that is rich enough to respond to the purpose and the research questions of the study (Etikan et al., 2016).

Figure 1.1

Research design, strategy of inquiry and data collection methods



Research purpose		Strategy of inquiry		
Qualitative exploratory design		Exploratory, Instrumental case study		
		Selection of research sites		Participants selection
		One HEI and seven schools (N=8)		In-service teachers (N=8)
Phases of inquiry				
Data collection methods and instrument (s)	Interviews	Observation	Document review	Researcher Journal
	<ul style="list-style-type: none"> • Semi-structured face-to-face interviews • Interview protocol • Digital recorder 	<ul style="list-style-type: none"> • Classroom observation • Observation Schedule • Digital video camera 	Artefacts: lesson plans, ICT policy documents, teacher, institutional artefacts	<ul style="list-style-type: none"> • Field notes • Informal conversation interviews
Analysis of data	Content analysis	Qualitative image analysis approach	Content analysis	Content analysis

The principal data collection method for this study was face-to-face semi-structured interviews. I observed the in-service teachers' classroom practices, where I situated myself as a reactive observer (Angrosino, 2012). This allowed me to observe activities happening in the classroom with minimum involvement in the teaching-learning. The interviews and observations took place over ten months. During this period, I also conducted an informal conversation with the participants, which I recorded in my field notes (Phillippi & Lauderdale, 2018). Document analysis also formed part of the empirical data. (see Chapter 3 for a summary of the selected documents).

Data analysis was accomplished through content analysis (Stemler, 2015). Codes were generated using data analysis software (Atlas.Ti) and subjected to continuous modification to accommodate new insights about the data (see appendix A). Through open coding, the extensive codes were further analysed *a priori* (Saldaña, 2021) to identify data related to the key constructs in the research question. The process was both reflexive and iterative in nature and produced extensive codes, categories and themes.

1.10.2 Enhancing the quality of the study

Ethically producing valid and reliable knowledge is a major concern in research. Hence, I attempted to enhance the quality of my study by paying attention to the issues of credibility, dependability, transferability and confirmability of my research results (Creswell & Miller, 2000; Patton, 2005).

- **Credibility**

Creswell and Miller (2000) define credibility as the extent to which different stakeholders may make the same inferences from data, and a researcher represents the reality from the viewpoint of participants, other researchers and external peers. To ensure credibility in this study, I spent about thirteen months in the field collecting data as a researcher. My decision to stay that long in the field was informed by Krefling (1991a), who posited that participants might volunteer different and more sensitive information than they did at the beginning of the research as the rapport increases or deepens. This period allowed me to establish the required familiarisation and trust from my participants (Silverman, 2013b). I was able to immerse myself in the research field to identify and verify recurrent patterns (Krefling, 1991b). This process is referred to as prolonged engagement

(Creswell & Miller, 2000). I then transcribed the data gathered from semi-structured face-to-face interviews and classroom observations and availed the transcripts to my participants to note whether I captured their views accurately as a form of member checking (Creswell & Creswell, 2017).

- **Dependability**

Dependability is data consistency over time and under varying conditions (Elo et al., 2014). According to Shenton (2004), dependability is a term used in qualitative research to indicate that if the research were to be repeated in the same context, using the same methodological approaches. With the same study participants, the results would be identical. As a result of detailed reporting and an audit trail of the study's processes, future researchers will be able to repeat the study, if not necessarily to achieve the same results. When the research steps are verified by examining raw data, data reduction products, and process notes, data consistency will be achieved (Golafshani, 2003)

- **Transferability**

Merriam (1998) defines transferability as the extent to which the results of one study are applicable to other settings or circumstances. According to Creswell (2014), a researcher can increase the transferability of their research findings by providing rich background information and a thorough description of the participants, research context, and setting. To increase the transferability of this study, I provide clear and distinct descriptions of the research site, the participant selection process, and a detailed account of the data collection methods and data analysis in the current study.

- **Confirmability**

Confirmability in qualitative studies is meant to ensure that the research findings are the result of the experiences and ideas of study participants and not the attributes or preferences of the researcher (Shenton, 2004). This study employed the triangulation strategy to establish confirmability. I employed triangulation for two reasons, firstly, to confirm data and secondly, to achieve completeness. Data completeness involves bringing together several standpoints from various sources to achieve a realistic picture of the phenomenon being portrayed (Emran, 2015). Triangulation refers to using several data collection techniques in the same study to ensure that one data collection method's weakness is

compensated by using alternative data gathering techniques (Denzin, 2012). A research result's confidence and credibility levels increase when data collected through several techniques are judged consistently (Houghton et al., 2013). Creswell and Miller (2000, p. 126) confirm that triangulation is a validity procedure that researchers use to search for convergence among multiple sources of information to derive themes or categories in the study. Triangulation helps the investigator reduce bias and cross-examine the integrity of participants' responses (Anney, 2014).

In the present study, for confirmation, I used and compared several data sources to determine the level to which the results could be confirmed. Four sources of data were employed in the study: semi-structured interviews, classroom observation, document analysis, and a research journal. Classroom observation, for instance, was conducted to establish how in-service teachers used ICT for teaching and learning activities to compare prior and present practice after their interaction with ICT at Horeb university. This approach is to confirm the responses given to some of the questions by the in-service teachers during the interview, in which they would be required to describe the specific changes they could identify in their practice after their ICT learning experiences at Horeb university. In this study, I dedicated special attention to ethical conduct to maximise beneficial effects and reduce any harmful effects of this study on the participants (Silverman, 2013a).

1.10.3 Ethical issues

In this study, I dedicated a special caveat to my ethical conduct to maximise beneficial effects and reduce any harmful effects of this study on the participants (Silverman, 2013a). Research studies are usually conducted in settings with common values, beliefs, population, culture and identity. Due to the level of involvement in the personal lives of study participants, qualitative researchers may, at times, be ethically conflicted. Several ethical issues were considered in the course of this study to guard against harmful consequences.

Before conducting the study, I requested permission from all the relevant authorities, including Horeb university and the schools, before contacting the potential participants. I also sought clearance from the ethics committee of the University of Pretoria before

commencing the data collection. Upon securing the required certificates, I contacted all the potential study participants via face-to-face discussion and phone conversation. Subsequently, all the in-service teachers who agreed to participate in the study validated their willingness by signing consent letters. This consent indicated that their decision to participate in the study was voluntary, and they were at liberty to withdraw their participation from the study at any time (see appendix B). Issues of anonymity and data were clearly specified in the letter. This study duly acknowledges and recognises all the authors of the literature consulted to avoid plagiarism.

1.11 Conclusion

Information and communication technology are employed in teacher training in different settings (Agyei, 2013; Bhattacharjee & Deb, 2016; Kalogiannakis, 2010) with the hope of preparing future teachers for the use of ICT in their classrooms. However, there is no clear consensus in research that the use of ICT in teacher training has or may influence teacher trainees' practice. The phenomenon has been interpreted and measured from different perspectives and explored from individual perspectives (Aslan & Zhu, 2016; Kalogiannakis, 2010; Martinovic & Zhang, 2012). The focus was on constructs or variables such as factors that hinder or prevent the use of ICT in today's classrooms, teachers' attitude, skills, and availability of tools. There is a dearth of literature on studies that have explored the use of ICT in teacher training and its influence on the practice of in-service teachers from a holistic point of view in both developed and developing countries.

1.12 Outline of Chapters

- **Chapter 1**

Introduction: This chapter focused on the background information that led to the study, providing a justification for the study and elaborating on the university and in-service teacher contexts. The introduction also covers the problem statement, the study's purpose, rationale, research questions, and a synopsis of the research design and layout. I highlighted procedures employed to achieve credibility, anonymity, and confidentiality as required by ethical considerations.

- **Chapter 2**

Literature Review: This chapter reviews relevant literature from empirical studies in the field of technology integration in teacher training both on the local and international landscape. Furthermore, it searches for issues surrounding the preparation of teachers for future practice with ICT. Fundamentally, the literature review was to determine what was already known in the field of my intended study; my curiosity was specifically directed at identifying the gaps and silences in the field that gave rise to this study. The chapter concludes with the theoretical framework (Activity Theory), which underpins this study.

- **Chapter 3**

Research Methodology: The research design and methodology are presented in this chapter. This chapter also describes the metatheoretical and methodological paradigms that support this study. In addition, it describes how the cases were chosen, the participants, the research sites, and the data collection methods utilized for this empirical study. The qualitative analysis methods used are explained, while the chapter also elaborates on issues of trustworthiness to enhance the quality of the study.

- **Chapter 4**

Research findings: This chapter is targeted towards the presentation of the findings and the interpretation of data collected from interviews, observation, document analysis, and field notes. The presentation is in the form of the themes and sub-themes that emerged from the analysis of garnered data. The emergent themes represent the in-service teachers' learning experiences and their classroom practice changes.

- **Chapter 5**

Analysis and discussion of the findings: This chapter summarises the study's key findings. I then locate the study's findings within the extant literature discussed in Chapter 2. Additionally, I engage the findings with the theoretical framework to reveal the new knowledge that emerged from my study.

- **Chapter 6**

Conclusion and recommendation: This chapter focuses on a brief review of the thesis, a discussion of the key findings, the implications of the findings, and the limitations of the

study. Subsequently, recommendations are made in light of the findings and suggestions for further research are also highlighted. I then bring the thesis to a close with my final conclusion.

2 CHAPTER TWO EXPLORING THE DEBATES IN THE FIELD

2.1 Introduction

Ridley (2012) described a literature review as a process and product of reviewing literature. The purpose of this chapter is to provide a review of extant literature on the rationale for distance education, distance education for 21st century teacher training, in-service teacher training, quality of ICT learning experiences in teacher training programmes, ICT practice of teacher educators, preparing teachers as change agents, teachers' classroom pedagogy and ICT, and the theoretical framework. This chapter also provides a summary of what is already known about the topic, thereby establishing a foundation that facilitates a theoretical comprehension of the research problem. This review is rooted in research based on international reports, academic empirical literature, ICT in teacher training projects and dissertations, and comparative studies, which span both developed and developing countries. Most of the research consulted in this study was carried out in the developed world. However, a notable amount of research from the developing world was also considered and scrutinised.

The research studies reviewed in this investigation included those published between 2000 and 2021. Literature and international studies carried out before 2000 were included because the research demonstrated an important contribution to the investigated field or because its inclusion represented crucial evidence supporting the origins or history of ICT in education and teacher training. The literature search keywords included distance education, in-service teacher training, ICT integration, higher education, Google Classroom, teacher professional development, TPACK competencies, 21st century ICT skills, teachers' classroom pedagogy, and learning management systems.

2.2 Rationale for distance education

The justification for employing distance education as a mode of delivery in institutions of higher learning cannot be overemphasised. The literature (Burns, 2011; Ramos et al., 2011; Sifuna, 2011; Smith, 2010) has established the positive impact and the many benefits of this mode of delivery worldwide. Distance education is defined as teaching and planned learning in which teaching typically occurs in a different location than learning, which

requires communication via technologies and special institutional organisation (Moore & Kearsley, 2011). According to Bates (2005), distance education is less a philosophy and more a method of education that allows students to study on their own time, at their own location (home, workplace, or learning centre), and without face-to-face contact with a teacher or instructor.

Through distance education, education opportunities are provided to people who would otherwise have been denied access due to geographical location, nature of employment, family responsibilities, gender, and financial status (Burns, 2011). Jimoh (2014) described it as a means by which the teacher is virtually taken to the learner. Additionally, a significant milestone achieved through distance education is learner autonomy. Sifuna (2011, p. 206) posits that “through distance education, the learner enjoys a high degree of autonomy in deciding what, when and how to learn”. Distance learning offers flexibility, and the fact that it can be combined with a full or part full-time job makes it specifically appropriate for teachers' often widely dispersed force. Furthermore, distance education supports lifelong learning, a critical norm for teacher professionalism. Teachers need more opportunities to continue learning throughout their careers, and one way the teaching profession can be strengthened is through distance education or open and distance learning.

The cost of obtaining a degree has been greatly reduced with the advent of distance education. Abedi and Badragheh (2011) stated that institutions that were constrained by the high cost of building facilities, hiring faculty and expanding curricula due to limited resources had found solace in distance education to maximise their resources. Most distance-learning universities operate a mixture of synchronous and asynchronous modalities. However, there is a tendency for larger education providers to emphasise individual learning because it enables many students to be catered for at a reduced cost. Although the cost-effectiveness of education through distance education has been argued back and forth by some researchers, I still believe that distance education facilitates reduced overhead costs. Students who study through distance education are required to spend less time on the campus in comparison to their full-time counterparts, thereby significantly reducing expenses like electricity, internet connectivity costs, and other general logistics required for their presence in the campus.

However, distance education has been criticised for its ineffectiveness in comparison with the face-to-face mode of teaching and learning. Orhan and Beyhan (2020) found that teachers considered distance education ineffective due to a lack of social interaction and prompt student feedback. Furthermore, students reported that technical problems hindered effective communication during the video conferencing session. Subsequently, student motivation levels were negatively affected. A study by Ndayambaje et al. (2013) opined that the diversification of communication channels would significantly enhance the much-needed interaction between learners, staff and tutors, strengthening the distance learning programme. Research has also indicated that faculty who teach in distance education programmes are usually drawn from traditional face-to-face programmes, hence many of them possess minimal experience regarding teaching in a distance education context; hence the effectiveness of the program is reduced (Mukamasoni, 2006; Orhan & Beyhan, 2020). Similarly, Markova et al. (2017) posit that to increase the effectiveness of distance education, faculty need to display a higher sense of commitment and attention to enable more control and foster adequate interaction with learners.

In the present study, distance education is referred to as the training given to in-service teachers through the combination of face-to-face lecture sessions, and online interaction through a Learning Management System (LMS) platform named Sakai, which can be accessed with any technology device from anywhere and at any time.

2.3 Distance education for teacher training

According to Burns (2011), in the teacher education context, distance education has more than one aim and audience; it has been used to prepare pre-service teachers using a comprehensive face-to-face method. It has also been deployed as an in-service vehicle to fulfil a mandate to upgrade the knowledge, skills, and qualifications of an existing teaching force in developing and developed countries (Danaher & Umar, 2010). Shelton Mayes and Burgess (2010) stated that open and distance learning has been adopted worldwide as the potential solutions to teacher education issues which include diversity, gender, access, quality, cost and supply, to mention a few. Similarly, distance education has been accepted and employed by many countries, particularly developing ones, including Rwanda, as a means to solve various teacher education problems. Problems of teacher quality such as

unqualified, underqualified, and shortage (Perraton, 2010; Perraton et al., 2001) of teachers have been adequately addressed through distance education (Danaher & Umar, 2010).

Rena (2007) opined that distance education allows for more females to be trained, In Eritrea, one of the objectives of the open and distance learning programme was to reach women who could not study through the conventional face-face mode because of religious and cultural reasons. This was echoed by Stuart et al. (2009), who argued that it is a convenient way of educating teachers (especially females), typically because it is less disruptive to family life compared to a residential course. This option often offers an advantage to women who have young children or are limited by either religion or culture but need to upgrade their qualifications. They argue that distance learning can reinforce the unequal position of women in society by allowing them to study in isolation for credentials that are sometimes viewed as less prestigious than those awarded by traditional colleges and universities. For some women, open and distance learning is their only opportunity to obtain a qualification; for others, it means that they must juggle multiple roles – teacher, mother, wife, part-time farmer, and student – instead of attending a residential college and focusing solely on their studies (Stuart et al., 2009).

The recurring demand for qualified teachers has put distance education at a significantly strategic point. Abedi and Badragheh (2011) posit that well-planned teacher education programmes facilitated through distance learning have a high potential to meet the demand for qualified teachers in Africa. Some countries which have taken advantage of distance education to solve teacher supply problems include South Africa, Nigeria and Zimbabwe. Distance education has played a very notable role in teacher education, as many primary and secondary school teachers have been trained through distance learning. The University of South Africa (UNISA) has been a major provider of distance and teacher education at the tertiary level throughout Southern Africa. It is one of the largest distance teaching universities in the world (Sifuna, 2011). Similarly, in United Kingdom, the Open University commenced the training of teachers through distance education after the need for more teachers was identified, especially in mathematics and science. Within a two years, twenty-one thousand students entered a full-time post-graduate certificate in

education (PGCE) programme in the UK and fourteen thousand enrolled in a Bachelor of Education programme (UNESCO, 2001).

In Nigeria, the National Teachers Institute (NTI) was established to train primary school teachers through distance education to solve the problem of a persistent teacher shortage. The institution's national certificate in education (NCE) programme has significantly impacted teacher supply in Nigeria (UNESCO, 2001). Similarly, in Zimbabwe, the Zimbabwe Integrated Teacher Education Course (ZINTEC), a distance education programme, was introduced to train primary school teachers. The programme was hailed as a huge success and helped alleviate the demand for teachers (Kangai & Bukaliya, 2011). Additionally, the Domasi College in Malawi annually enrolls more than 900 distance teacher-learners. It now caters for all conventional colleges in the country where continuing professional development of teachers can only be ensured through the distance mode. The dual-mode institution uses distance education for teacher education to improve the quality of education in less privileged community schools, increase equity and access, reduce gender disparity, and enhance school system efficiency (Chakwera & Saiti, 2005). In addition, it has been acknowledged that distance education is suitable for reaching widely dispersed populations without interfering with their personal, professional, and social lives. (Sifuna, 2011).

Teacher trainees in traditional initial teacher training have complained that they have limited opportunities to engage in actual teaching activities until the internship, which often comes towards the end of the programme (Johnson & Arshavskaya, 2011). This sentiment echoes the argument of McGrath (1995) that "most of what is taught in intensive programmes evaporates before it can be applied in the classroom". Furthermore, Goodwin (2010) also reported that when teachers do not use their newly gained ICT knowledge and skills immediately, their knowledge "atrophies" and "deskilling happens". Based on what I have observed in the field as a teaching practice supervisor, this a true representation of different scenarios. In-service teachers immediately practice what they have learnt as they return to their classrooms. I agree with Kangai and Bukaliya (2011), who argued that in-service education addresses the theory and practice question more effectively because

learnt skills, methods and techniques are applied in the classroom immediately rather than waiting for the future when students are in teaching practice.

The reasons identified above, among many others, served as a backdrop against which distance education as a delivery mode was recommended by the World Conference on Higher Education (Paris, 1998), the World Forum on Education (Dakar, 2000) and the ILO/UNESCO Committee on the Application of the Recommendations concerning the Status of Teachers (Geneva, 2000). It is important to examine in-service teacher training and the dimensions from which it is employed to train prospective or continuing teachers, having established the rationale for distance education in teacher training. I focused on the international perspective, East Africa as a region and Rwanda specifically, to describe the in-service teacher training landscape.

2.4 In-service teacher training

Osamwonyi (2016), describes in-service training as the relevant courses and activities in which a serving teacher may participate to upgrade their knowledge, skills, and competence in the teaching profession. It encompasses all forms of education and training given to a teacher already on the job. Hence, one of the many purposes served by in-service teacher training is facilitating the initial training of unqualified teachers. It is “the basic or first level of qualification for a teacher. It may be taken as a pre-service programme (before a trainee teacher begins work as a teacher) or an in-service one (while an untrained teacher is working as a teacher)” (UNESCO, 2001, p. 2). Many teachers start to work without the basic qualifications required of them with the hope of acquiring a degree while they are working (Perraton, 2010). Evidenced by a synthesis report compiled by Junaid and Maka (2015), the in-service approach to the training of teachers is prevalent in sub-Saharan Africa due to factors such as a high percentage of uncertified and poorly equipped teachers.

In-service training helps to prepare teachers for new roles that their jobs may demand and in cases where a teacher needs to take up a new role or position, in-service training can be used to prepare such an individual. According to Omar (2014), in-service teacher training has been an impetus for decades for changes in teaching and learning. In-service teacher education enables teachers to extend their existing knowledge and skills and develop new ones. Some of these may take the form of long structured courses leading to formal

qualifications such as diplomas, bachelor's, or master's degrees (Osamwonyi, 2016; UNESCO, 2001). In-service teacher training also caters for upgrading teachers who already have a teaching qualification which is not equivalent to the set standards of a country (UNESCO, 2009). In-service teacher training in the context of this study refers to the training received or given to teachers already practicing in the classroom without the required qualification (Paul et al., 2013).

In the Rwandan context, trained teachers are expected to acquire qualifications at different levels, qualifying them to teach various levels of learners ranging from primary to lower and upper secondary. The lowest level is the Senior 6 certificate which can be acquired from Teacher Training Colleges (TTC), referred to as the "A2" diploma certificate. The Advanced Diploma in Education, referred to as "A1", is the middle-level certificate obtained after two years of study at the university. The highest level of teacher qualification is the bachelor's degree obtained from the university after three–four years of study, known as "A0". Underqualified teachers get an opportunity to upgrade through the in-service teacher training programmes provided by various universities approved by the Higher Education Council to offer education courses. The participants in the current study were enrolled in the university to obtain a bachelor's degree, also known as "A0".

2.5 21st century teacher training and ICT

Teacher training has evolved in recent years due to the changes that have occurred in the classroom over time. The last three decades have witnessed substantial investment in technology tools and resources in the school setting. The recent changes seen in the classroom due to the presence of ICT expectedly call for teachers who can effectively use technology for teaching and learning. Hence the skills required of teachers in the 21st century have changed, the question is no more about if ICT should be used in the classroom, but about how ICT can be used effectively (Kalogiannakis, 2010). Significantly, one of several fundamental skills this generation of teachers requires to function maximally in their classrooms is the effective, purposeful and goal-oriented use of ICT for teaching and learning. Acquiring these skills would help teachers effortlessly develop the required skills in their learners needed to fit seamlessly into the 21st century workplace.

The role of ICT in teacher training as a catalyst for change remains unchallenged. I mentioned earlier that the integration of ICT into teacher training is commonly carried out in two ways. Firstly, the goal is to teach teacher trainees “about” ICT use in the classrooms. This goal has been achieved in many teacher education programmes by making ICT courses compulsory for all teacher candidates. Secondly, ICT is used for teacher education or as a core or supplementary programme component. Presently, teacher training programmes combine both. Therefore, this study focused on the latter as the major concern was to investigate if the ICT experiences of teacher candidates transformed or influenced their classroom practice. Admiraal, Lockhorst, Smit, and Weijers (2013) argued that increased attention to the use of technology in teacher education programmes might help future teachers to cope with the demands of technology use during school practice, thereby making the learning process more effective. Hence, infusing ICT into teacher training in the 21st century became necessary.

Equipping the current teacher workforce with the knowledge and skills to use ICT effectively in the classrooms makes integrating ICT into teacher training essential (Kalogiannakis, 2010). According to Tican and Deniz (2019), inculcating and developing the competencies required for these skills has been undertaken significantly by teacher training institutions. Teacher training programmes offered through the pre- or in-service mode play a major role in preparing teachers capable of efficient and meaningful use of ICT tools and resources in the classroom (Tondeur, Pareja Roblin, van Braak, Voogt, & Prestridge, 2017). Liu (2016) argued that teacher training should be structured to prepare teachers for using ICT in their classrooms. Teacher training programmes need to build a strong ICT-based foundation for teachers to ensure that using ICT for teaching and learning in their classrooms is without difficulties (Voinea, 2019). Admiraal et al. (2013a) opined that teacher training programmes should be in place where teachers as learners can learn about the most recent and innovative technology. I believe that to achieve this feat, learning in the teacher training context must be technology integrated. In other words, the curriculum, teaching methodologies, pedagogy and learning activities must be infused with technology.

Similarly, Ertmer and Ottenbreit-Leftwich (2013) maintained that ICT must be used to engage in meaningful learning activities. According to Ertmer and Ottenbreit-Leftwich (2010), students' most common learning experience with ICT is searching for information online and completing assignments. I argue that ICT in the teacher training context must be put to better use than this; it must be used to facilitate teacher trainees' engagement in more meaningful learning through changes to teacher training programmes made possible with the fusion of ICT.

The increasing availability of new technologies for teaching and learning seems to suggest that teachers' preparation to teach in this millennium may be fundamentally different from previous approaches (Ajayi, 2009). In the past decades, teacher-training programmes prepared teachers to perform tasks aligned with the traditional roles and functions of schools (Kalogiannakis, 2010). However, a critical look at the situation today reveals this has changed, as ICT plays various roles ranging from mediating the teacher, the learner, and the content to facilitating more modern and flexible interactions (Namdev, 2012). This enhances lifelong learning and improves the quality of learning. The ICT tools and resources used in teaching influence both teachers and learners (Schulz et al., 2015). Accordingly, to establish this thesis' relevance, there is a need to examine how technology has been used in in-service teacher training (what tools have been used and for what purpose). It becomes important to examine ICT as core technology in the teacher preparation process, what has been tried, and the lessons learnt. I focused on ICT tools, namely the Learning Management Systems, Video Conferencing, Web 2.0 tools and a variety of other ICT tools used for teacher preparation, especially in in-service teacher training.

Research has advocated for different strategies of infusing ICT into teacher training experiences to facilitate the effective preparation of teachers for the use of ICT in their classrooms (Baran et al., 2019; Cuhadar, 2018; Divaharan, 2011; Hennessy et al., 2010). Strategies suggested include infusing ICT into all subjects across the teacher education curriculum, teaching of ICT as stand-alone subject, modelling of ICT use by teacher educators, and modifying the pedagogical approaches to reflect the integration of ICT into teacher preparation programmes, to mention a few. While different teacher training

institutions worldwide have explored some of the strategies mentioned above, these studies have reached different findings regarding the effectiveness or otherwise of these strategies. The reasons for the variations in the results and experiences have hinged on factors such as context, access to ICT tools, policies, pedagogical approaches and structure of teacher education curriculums (Kalogiannakis, 2010). However, despite the lack of consensus in the research findings, a fact that cannot be overlooked, as established by research, is that the integration of ICT underpins the “successful” preparation of teachers in the 21st century in teacher training programmes. In other words, teacher preparation cannot be separated from the use of ICT; hence it is imperative to explore some of the tools employed by teacher training institutions and their effectiveness. Technologies such as learning management systems, Web 2.0 tools, mobile devices and many others have been infused into teacher training, leading to different learner experiences with the tools.

2.5.1 *Learning Management Systems*

Watson and Watson (2007, p. 28) define a learning management system (LMS) as “an infrastructure that delivers and manages instructional content, identifies and assesses individual and organisational learning goals, tracks the progress towards meeting those goals, and collects and presents data for supervising the learning process as a whole”. An LMS has also been defined as a web-based program that enables educators to create, organise and deliver instructional content to learners, collect data on assessment and performance and communicate information to students and parents (Klobas & McGill, 2010; Lochner et al., 2015). Furthermore, (Haidar & Abdul Majeed, 2010) held that learning management systems facilitate students’ electronic access to course material, and can be used to upload or submit assignments, view assessments made, and facilitate online interaction between instructors and students. It provides a facility for document repositories, discussion forums, online chat rooms, grade books, and the ability to track students’ performance. When an LMS is employed as a course-support site, traditional (face-to-face) lectures are supplemented by a parallel website for the course, with exercises and practice drills, enrichment, and in-depth study of the subject (Frank & Barzilai, 2004). Tredoux (2012) argued that LMS does not allow for the full potential of interactive learning to be realised as learners absorb knowledge passively, however, two different subsequent

studies have been able to refute this claim by reporting that LMSs do facilitate collaboration, active and interactive learning (Özden, 2016; Susana et al., 2015). A mixed method study conducted by Özden (2016) on determining the perception of teacher candidates towards scientific research processes revealed that teacher candidates' perception of science changed due to out-of-class activities mediated through the learning management system. Significantly, it was discovered that an LMS provided an appropriate learning environment to facilitate this change. In other words, teacher candidates find the opportunity to work together both in the classroom and outside the classroom, thereby establishing the notion that an LMS facilitates collaborative learning. Edmunds and Hartnett (2014) found that using an LMS opens students and teachers up to various interactive activity options, including hosting online discussions where all students can participate and voice their opinions. Another study in Spain, conducted by Susana, Juanjo, Eva, and Ana (2015) on how lecturers and students in the faculty of education use Moodle as a learning management platform, found that the Moodle platform promoted fluid communication between students and lecturers and continuous exercise of tutorial action with the lecturer.

Carvalho et al. (2011) conducted a study to compare Moodle and Blackboard as LMS platforms in Portugal. The findings from the study revealed that students found accessing the Blackboard platform easier, while logging into the Moodle platform was difficult. Regarding the usefulness of LMS for learning, the participants indicated that LMSs benefit their learning when employed as a complementary learning platform rather than substituting for face-to-face learning. Carvalho, Areal, and Silva (2011) posited that the burden of achieving increased learner engagement using LMSs rests more with the faculty. Meaningful and engaged student-faculty interaction depends on how courses are designed and managed by faculty on the platform. Furthermore, students rely on faculty for support, guidance and feedback while using the platform for learning.

2.5.2 *Video conferencing*

Video conferencing is interactive and synchronous voice, video and data transfer conducted between two or more points via communication lines. Also, it offers a connected environment where students can relate their experiences to each other; and a feeling of

togetherness is created, along with the benefit of expert instruction (Karal et al., 2011). Video conferencing is a powerful distance education tool because it approximates face-to-face interactions at a distance. In the United States, a professional development project facilitated teachers in one location to collaborate in group-based activities with teachers in another. Teachers could remotely participate in learning experiences that might otherwise have been inaccessible and view live examples of the types of instruction they should and should not be doing (Burns, 2011). Using video conferencing for teaching and learning is underpinned by the connectivism learning theory principles. These principles allow a learning environment where learners and teachers can be connected from different locations via internet technologies.

Student teachers' perspective on video conferencing in a distance education programme in Scotland revealed that the use of video conferencing allowed for genuine social presence, which fostered interaction, improved student engagement, and, more importantly, allowed the students to live, study, and undergo school placements in their home areas (Gillies, 2008). The study involved thirty students in a one-year graduate course in initial teacher education, aimed at examining pedagogical and social issues pertinent to videoconferencing, as seen from the student perspective, to improve practice and provide a better learning experience for teacher trainees. The study found that teacher trainees perceived video conferencing as potentially useful in fostering interaction between lecturers and students. However, there were records of lack of engagement while learning and technical issues as with other ICT tools.

Doggett and Mark (2008), in their study on the perceptions of students about the effectiveness of video conferencing, found that students who learnt remotely were not comfortable with not having a teacher in the classroom with them. Students indicated their preference for face-to-face interaction over the video conferencing course format. Furthermore, the study found no significant difference in students' achievement in the course compared to face-to-face courses. Lai and Pratt (2009) opined that teachers' knowledge of technology integration is crucial to effectively using video conferencing to ensure the adequacy of interaction among students and teachers. Drexhage et al. (2016), elaborated on the usage of video conferencing to connect theory to practice, arguing that

video conferences allow learning that transcends reflection. The authors argue that video conferencing enables trainee teachers to observe lessons and communicate with teachers and pupils before and after the lessons. Teacher trainees developed innovative teaching ideas and explored different concepts and methods.

In Rwanda, as with other East African countries, the adoption and use of video conferencing tools by higher learning institutions are rare. Institutions of higher learning, including teacher training institutions, are yet to embrace video conferencing technologies for teaching and learning due to some of the above-identified factors. Lemy (2020) found that a lack of teacher training and inadequate digital skills for university teachers significantly hindered the use of video conferencing for teaching. The university teachers lacked technical and pedagogical skills to facilitate learning through video conferencing tools; hence its use for teaching remains rare.

2.5.3 *Web 2.0 tools*

Web 2.0 technologies and tools have gained popularity in the education sector, particularly in higher education. Research has reported positively on the capability of the Web 2.0 tools to facilitate opportunities for educators to improve communication and sharing within their classes (DiBella et al., 2015). Web 2.0 tools are characterised by user-friendliness and ease of use. They make lessons more entertaining and increase the technological literacy of learners (Sadaf et al., 2012). Bower (2015) categorised these tools according to specific purposes and affordances. These tools seem to be underutilised by educators as only a few functions, such as video tools, presentation and video streaming, are employed for teaching and learning. Tatli et al. (2019) found that Web 2.0 tools were effective in creating digital learning materials and that the tools were beneficial in terms of the learning environment, teaching and course content. According to An and Williams (2010), Web 2.0 tools facilitate collaboration, communication, flexibility and knowledge creation. Similarly, in their study, Can et al. (2019) found that faculty members use Web 2.0 tools to strengthen students' knowledge and understanding while trying to engage them with supplementary learning materials inside and outside the classroom. Furthermore, the academics in the study were selective in their use of the tools based on the purpose each tool served.

Teacher training institutions are also exploring the usefulness and effectiveness of these tools for more engaging and meaningful teaching and learning. A study by Wolfenden et al. (2019) targeted teacher educators across three east African countries, revealing that more teacher educators are exploring the use of open education resources, which include Web 2.0 tools, by experimenting with more participatory and interactive teaching strategies facilitated by these tools. The teacher educators reported using YouTube videos in their preparation for teaching and while introducing new concepts to trainees. Furthermore, the use of multiple sources for accessing knowledge was valuable to teacher trainees, as this disrupted the thinking that knowledge is only available to a few privileged people.

2.6 Quality of ICT learning experiences in teacher training programmes

The quality of ICT learning experiences in teacher education programmes has been identified as pivotal to the future use of ICT in classroom practice (Tondeur et al., 2012; Voogt et al., 2013). Since policies targeted at the educational benefits of investments in ICT identify teachers as frontline implementers, innovations and changes in teacher training have become crucial (Kirschner & Selinger, 2003). Hence, teacher training programmes are burdened with the responsibility of preparing teachers who understand the need for change and accept the challenge to drive the change (Hennessy et al., 2010). Research has emphasised that teachers as learners should be allowed to have quality technology experience for them to replicate the same in their classrooms (Brown, 2017; Voogt et al., 2013).

Recent changes in the education landscape have led to the increased demand for a generation of teachers open to learning, unlearning, and relearning with constant open-mindedness to new classroom practices (Lim, 2007a). Teacher trainees, therefore, require a new set of learning experiences that provides opportunities for hands-on experiences that allows them to explore and harness the power of new technology (Røkenes & Krumsvik, 2014). Research confirms that achieving this feat often demands a wide range of review and adjustments to design, policy, curriculum, and implementation strategies employed in teacher preparation (Baran et al., 2019). Learning experiences in teacher training institutions should be targeted towards achieving a shift in the trainees' perspective, thereby achieving transformative learning (Reményi, 2016). Similarly, to achieve a perception shift

among teacher trainees, Cheok et al. (2016) posited that it is crucial to expose teacher trainees to the use of technologies as this would help to improve their use of ICT for instructional purposes.

A qualitative study by Baek et al. (2018) involving nine physical education teacher trainees aimed at examining their perception of technology-related learning experiences revealed that teachers felt that the focus of their training was directed more towards how to use ICT tools rather than actually using it for teaching and learning (pedagogical purposes). One of the themes that emerged from the qualitative data coding was “technology-centric experience”, which emphasised technological knowledge rather than technological pedagogical knowledge. Students felt that instructors focused more on “introducing the functions and operational aspects of the technologies themselves, instead of their practical or useful applications to teaching” (Baek et al., 2018, p. 6). The participants in the study failed to connect their technology learning experiences with their teaching practice (pedagogy), as they felt dissatisfied and unfulfilled as professionals. The study participants represented three different levels of programmes, including pre-service, in-service and post-graduate levels. This weakens the study's findings due to the possibility of an inaccurate recount of past learning experiences.

Chigona (2015) investigated the reasons for the seemingly under-preparedness of new teachers to use ICT in their classrooms despite having classrooms equipped with ICT tools and resources. The finding revealed the quality of instruction received during training as the major contributing factor. The study, which was guided by the TPACK theory, opined that the pre-service teachers were taught content and pedagogical knowledge. However, the inability of the lecturers or instructors to ensure that students were acquainted with the required and more holistic technological, pedagogical content knowledge resulted in new teachers lacking the confidence to integrate ICT in the classroom.

Experiences of teachers as learners with ICT differ based on context and perspectives. While some experiences are positive and increase the likelihood of future use of ICT in their individual classrooms, others are negative and could be a deterrent to the use of ICT in the classroom. Teachers' experiences as learners in developed countries where there are diverse technology tools, functional internet connections and where research-based

knowledge about on the use of technology might differ from developing countries where the situation is the opposite. A study carried out by Kounenou et al. (2015) in Greece revealed that teacher trainees' intention to use ICT dropped, as was revealed by their responses after they were exposed to an intervention programme that combined blended learning and learning design. They became overwhelmed by the quantity of material to the extent of being unable to put acquired information into practice. Another study conducted in Spain involving in-service teachers revealed that the impact of traditional training on ICT use is very low and teachers did not frequently use ICT in their classrooms. Therefore, new training alternatives should be incorporated into teacher education programmes to facilitate more learner-centred approaches (Sánchez et al., 2012).

I argue that the general lack of consistency in the quality of ICT experiences leaves many teachers feeling inadequate regarding technology use and integration in the classroom. Teachers are confronted with constant changes in the education landscape, such as curriculum content, new tools, learning environment and assessment strategies. Subsequently, they are expected to respond to these changes to remain relevant. Studies have shown that the inability of teachers to use technology in their classrooms can be traced to the type and quality of preparation received at teacher training institutions (Hennessy et al., 2010; Tondeur et al., 2017).

- **Constructivist paradigm shift in teacher training**

Constructivism is the most prevalent learning philosophy currently guiding educational researchers and practitioners (Veletsianos, 2010). There is a connection between constructivism and the works of Jean Piaget, John Dewey, and George Mead. Constructivists have emphasized the contextual nature of learning and have argued that learning is most effective when the task and context are authentic and meaningful to the learners (Sánchez & Alemán, 2011). Individuals construct meaning based on experience and prior knowledge, as per the constructivist view of learning. Through an active process involving the learner, knowledge is not passively acquired but rather actively created. In a constructivist learning environment, students build their own knowledge and apply it to new tasks, contexts, and situations, integrating the new information into their existing knowledge structures (Magambo, 2007). Moreover, according to Burns (2011),

constructivism is a philosophy that emphasizes learning through experiences and awareness. Within a constructivist framework, learning is a pursuit of comprehension and significance. By interacting with diverse experiences, resources, and individuals, the learner actively constructs knowledge.

Teaching and learning are complex processes requiring multiple tasks, efforts and flexibility of teachers and learners (Van Jaarsveldt & Wessels, 2015). Spanning the last twenty years, the effective use of ICT has become an important topic in education (Martinovic & Zhang, 2012). The real promise of technology in learning is to use it so that both teachers and learners can do things they could not do previously (Chainda, 2011). Debates and arguments are ongoing whether students learn about, with or through ICT. Vandeyar (2015) posited that the importance of ICT in teaching and learning processes is unarguable because ICT may be seen as the “mediator or a bridge” among factors intervening in teaching and learning. Similarly, other researchers (Mikre, 2011; Noor-Ul-Amin, 2013) have argued that ICT can enhance the quality of education in several ways; by increasing learner motivation and engagement, facilitating the acquisition of basic skills, and enhancing teacher training (Noor-Ul-Amin, 2013). There are several arguments on the effect of ICT on learning. Rogers and Newton (2001) have reported that after some years of ICT utilisation and research into its effects, there is still some uncertainty over its educational merits and demerits.

My argument is that in-service teachers as learners should be guided to construct their own knowledge and make meaning from their experiences for them to be able to transfer whatever they are learning to other contexts outside the university environment. I believe that ICT can be used to facilitate and support constructivist teaching and learning in this context. Usun (2009) opined that to train teachers in the field of pedagogical use of ICT in their classrooms, teacher education curriculums must be rescued from the traditional behaviourist approach, and a cognitive constructivist approach must be embraced instead. Research has also indicated that ICT allows for transforming a teaching environment into a learner-centred one (Sánchez & Alemán, 2011).

Teachers as learners should be engaged more in learning activities that require the use of ICT. In reviewing various teacher training curricula, Svenssona and Baelob (2014) found

that more activities focused on acquiring technical skills instead of learning activities related to improving the pedagogical use of ICT to enhance learning. ICT, particularly computer and internet technology, enables new methods of teaching and learning instead of merely allowing teachers and students to perform the same tasks more efficiently. ICT influences what students should learn and plays a significant role in how students should learn. Chainda (2011) referred to learners (in-service teachers) as passengers in the vehicle of ICT, who are not in control and can be directed at will by the teacher educator through their ICT skills and usage. She argued further that if ICT is not appropriately used, it may not result in learning. Teacher educators must plan carefully and design interactive learning activities which require students to interpret, argue, practice and transfer ideas to other situations. This approach brings the practice of teacher educators to light, which I will discuss in the next section.

2.7 ICT Practice of teacher educators

Research has sustained the argument that teacher educators have an essential part to play in equipping teachers with skills to deliver the curriculum and function as role models in ICT-integrated teaching techniques by using digital tools for instruction (Amhag et al., 2019). Modelling by teacher educators is characterised by the demonstration and promotion of specific teaching behaviour and practices that could shape student teachers' professional learning (Røkenes & Krumsvik, 2014). The emphasis was on teacher educators modelling interactive and participatory, rather than transmission-based pedagogy, in teacher education programmes (Agyei, 2013). Mukuna (2013) posits that the extent of the knowledge and skills possessed by teacher educators for modelling the use of ICTs in their own teaching practices is critical to the effective integration of ICT into teacher education.

A review of qualitative studies by Tondeur et al. (2012) on strategies that can be employed to prepare pre-service teachers for ICT integration identified six micro-level strategies that can be used in teacher education programmes to achieve this purpose. One of the most useful strategies identified in this study was role modelling. Observing a mentor or instructor use technology while teaching can influence a teacher trainee to use the same methods or technologies in their classroom. Two reasons to justify the above statement are

firstly; they can have the required experience and skills needed to use the ICT tools and secondly, as students they can benefit from the pedagogical values that such experiences add to their learning, thereby strengthening the likelihood of using ICT in their practice.

However, despite this strategy's potential, recent literature has shown that there is still a general lack of appropriate modelling of ICT use for pedagogical purposes by teacher educators. Research evidence proves that teacher education programmes have failed to adequately model good practices regarding the pedagogical use of ICT for teaching and learning. As a follow-up to the 2012 study, another study by Tondeur et al. (2019) verified the effectiveness of the strategies suggested previously. The findings revealed that teacher educators were not perceived as role models based on how instructors used ICT to facilitate teaching and learning. Pre-service teachers stated that they did not experience adequate modelling from their instructors; hence turning theoretical knowledge into practical skills became difficult. A similar study by Amhag et al. (2019) conducted in Sweden, which aimed at evaluating the use of digital tools for teaching by teacher educators based on the TPACK model, revealed that although teacher educators used ICT for other reasons, they did not use ICT as a pedagogical tool to facilitate improved student learning. This was traced to the fact that teacher educators could not identify the “pedagogical surplus” value of teaching with digital tools.

Thus, I argue that the instructional use of ICT in teacher training should be a more student-centred activity that facilitates the exploration of pedagogical approaches that will help teachers to create impactful learning environments in their classrooms. Teacher educators should make efforts to employ varied methods of ICT use to facilitate more engaging and meaningful learning experiences that teachers can observe and, in turn, emulate or recreate in their own classrooms. Foulger et al. (2015) argued that meeting the conditions of hands-on modelling of the content and pedagogical use of ICT by teacher educators holds great promise for teacher trainees’ future use of ICT for teaching. Pre-service teachers need to see and experience the pedagogical integration of ICT during their training experiences (Tondeur et al., 2012).

2.8 Preparing teachers as agents of change

Studies have consistently argued that change can only be achieved through teachers. They have been recognised as the major key players in achieving transformation in the world of education (Levin & Wadmany, 2008). Education is the only means through which any form of change can take effect in our society; therefore, the custodians of education must be ready to take up the challenge and prepare a generation of critical, creative and universal learners. I, therefore, argue that in-service teacher training is a means, not an end. It is a process that can be used to drive change and transformation in today's classroom. In-service teacher training can facilitate knowledge acquisition for teachers to prepare them for the 21st century pedagogy needs. This would then enable them to cope with the ever-changing teaching and learning landscape to achieve improved classroom pedagogy, which brings about improved learner achievement (Burns, 2011). Furthermore, in-service teacher training bridges the gap between theory and practice.

However, a major concern in all teacher education programmes, whether distance education or traditional, is to convert what teachers know into what teachers do to support teaching and learning; therefore, preparation and pedagogy are quite important. I am always observant of practising teachers to see if there is any indicator that they put into practice what they have been taught during their stay on campus. Since change does not occur in isolation, the methods and strategies employed in the training of teachers need to change. Baran et al. (2019) maintain that teacher training programmes need systematic strategies and practices to train teachers who can effectively use ICT in their classrooms. Mahmud and Ismail (2010) similarly stated that relevant authorities must take dynamic and proactive measures to ensure teachers are fully prepared to teach 21st century learners who are heavy users of technology in the real world outside the classroom. Their argument was supported by Tondeur et al. (2012) who also stated that teaching and learning in pre-service and in-service settings need to support teachers to change their pedagogical approach and to learn how ICT can be used to facilitate new pedagogical approaches to achieve this. Teachers must be trained in skills, methods and ways of teaching (Svenssona & Baelob, 2014).

I believe that desired change can only become a reality through adequate and thorough preparation of teachers through and with ICT. In other words, ICT should be employed as an instructional tool through which teachers can be trained (a main or core component) of the programme and as part of the curriculum content, such as ICT courses. I am more in support of the former. Anderson (2008) reported that using ICT to train teachers is accepted as adequate to make teachers more technologically skilled and motivates them to use the same technologies after training. The purpose of ICT in teacher training programmes is for acquiring technical skills and for the trainees to use these skills to enhance the quality of teaching.

However, gaps in the preparation of preservice and in-service teachers to use ICT has been identified through research. Research has reported that despite the effort of governments to invest in instructional technologies, including computers, mobile devices, and interactive boards, both pre- and in-service teachers are not sufficiently prepared to use these technologies in their classrooms (Agyei & Voogt, 2012; Cuhadar, 2018; Ertmer & Ottenbreit-Leftwich, 2013; Nut, 2010). The lack of adequate preparation has been linked to many factors, one of which is the inability of teacher educators to model the use of ICT as they teach these teacher-learners. UNESCO (2008) stated that “unless teacher educators model effective use of technology in their own classes, it will not be possible to prepare a new generation of teachers who effectively use the new tools for learning”. Therefore, ICT competencies must be integrated into the curricular and pedagogical content presented in preparing teacher candidates. These competencies would facilitate the creation of new learning environments where teacher educators can model the use of new technologies in their own university classrooms.

I argue that teacher-learners should be made to engage with ICT in the process of learning. The ICT experiences of teacher learners need to be examined through a different lens; research has identified that quality ICT experiences and training provided in teacher preparation programmes is a critical factor for influencing the use of ICT in their future classrooms (Agyei & Voogt, 2012; Stobaugh & Tassell, 2011; Tondeur et al., 2012). The argument above is congruent with Meagher et al. (2011). They showed that the extent to which teachers are willing to employ ICT in their classrooms is determined by their

personal experience with technology. Similarly, Bahati (2011) also noted that for teacher trainees to become confident and competent users of ICT in their own classrooms, it is important for them to see their instructors using various technologies for instructional purposes. In other words, the more comfortable teachers are with ICT during training, the more likely they will use it in their future classrooms. For instance, a study conducted in Singapore by Divaharan (2011) with primary and secondary school pre-service teachers, who were taught the theories and principles of technology integration, and practised with interactive whiteboards and video sports games, revealed that teachers need to be comfortable with the technology skills first before they can consider designing and integrating ICT into their lessons. The participants reiterated that once they were comfortable with the ICT skills, they could explore pedagogical approaches in the classroom.

In other words, the focus of preparation of teachers through the in-service approach should be on the teacher as a learner; and learner centred. This would allow teacher candidates to experience the type of instruction they are expected to replicate in their future classroom. To achieve learner-centredness in teacher training, a shift in paradigm from behaviourism to constructivism becomes inevitable. It is important, therefore, to explore the shift to constructivism, what it entails and how it affects teachers as learners.

Professional development has been described as an ongoing process that aims to improve teaching and learning through changes in teachers' and other education stakeholders' knowledge, beliefs, and attitudes. Providing adequate opportunities for personal growth and professional development through regular training remains one of the most important factors in determining the quality of a teacher (Junaid & Maka, 2015). Rapid technological advancements indicate that teachers' knowledge and pedagogical skills become obsolete rapidly on a global scale (Nzarirwehi & Atuhumuze, 2019). Therefore, teachers must engage in ongoing professional development. It is on this premise to remain relevant and equipped with the necessary knowledge and skills. Building the capacity of teachers to use ICT in their classrooms necessitates the creation of a context that allows teachers to critically examine their own pedagogical beliefs and explore the application of ICT in more

constructivist learning environments through the use of appropriate professional development programmes.

Teachers will likely adopt more constructivist approaches in ICT-enabled teaching and learning only when they have received relevant training (Lim, 2007b). Reményi (2016) posited that the teacher trainers' challenge is to design effective in-service training programmes that make the teachers change their practice and enable them to grow professionally.

However, a homogeneous problem with teacher development programmes is that they are designed in line with current school trends rather than on well-considered learning goals of the teachers themselves (Little, 2012). Existing disconnects between professional development programmes and the needs of the teachers reduce the effectiveness and relevance of such programmes. According to Patton et al. (2013), providing teachers with the liberty of setting their professional learning goals, identifying what is needed to reach the goals, and supporting them with a conducive environment for learning increases the success of teacher development activities. For instance, Desta et al. (2013) found that teachers displayed low levels of interest, commitment, and collaboration towards newly introduced professional development due to topics that lacked connections with student learning. Teachers participated in the professional learning activities more as a way of meeting formal requirements rather than as genuine efforts to enhance their performance. Similarly, Darling-Hammond and McLaughlin (2011) argued that professional development strategies ought to be "bottom-up" approaches where teachers share what they know and want to learn. These development strategies would help teachers to link what they have learnt in their teaching effectively. Accordingly, I argue that teachers should be allowed to determine their goals in any professional development activity. Teacher professional development should focus on what teachers want to learn rather than what teachers need to learn. Teachers, as professionals, are capable of rethinking and critiquing their own practice. Hence, teachers should be active participants in the design of learning programmes targeted towards their development.

2.9 Teachers' classroom pedagogy and ICT

The ability of ICT to change or transform classroom pedagogy is undeniable. New technologies challenge existing teacher practices and require new thinking and teaching skills (Conole & Alevizou, 2010). Studies have shown that teaching approaches have been influenced by the use of ICT for teaching and learning (Loveless, 2011; Vandeyar, 2020a; Webb, 2013). When ICT is placed in the right hands and appropriately used for specific purposes, ICT can effectively support teaching and learning in the classroom (Hennessy et al., 2010). Hence, the changes brought by the advent of ICT into the classroom are calling into question the traditional teaching approaches. However, technology does not produce intellectual engagement on its own. It is not technologies, but educational purposes and pedagogy, which make using ICT for teaching and learning more meaningful (Chen et al., 2010). According to M. Koehler and Mishra (2009), solving the problems that teachers face about how to integrate technology into teaching and learning requires an approach to teaching that sees “teaching as in interaction between what teachers know and how they apply what they know in contexts within their classrooms” (Koehler & Mishra, 2009, p. 3). The authors argue that three components are central to good ICT teaching: content, pedagogy, and technology. The interaction among all three components plays out differently across different classroom contexts due to varying peculiarities. The ability of teachers to create non-traditional learning environments by combining technology with pedagogy determines the success of ICT integration into teaching and learning. In recent years, research has shown that teachers are employing more ICT in their practices; however, rather than facilitating the engagement of learners with ICT in the classroom, teachers have only used ICT for other purposes such as record keeping and lesson preparation. A European survey indicated that teachers largely used ICT for lesson preparation rather than engaging with it for lesson delivery (Wastiau et al., 2013).

As actors and key decision-makers in integrating ICT into classroom practice, teachers' performance in demonstrating knowledge and understanding is important. ICT integration into teaching and learning is not merely a function of the presence of computers in the classroom; neither is it about the use of technology to support traditional teaching methods (Smaldino et al., 2008). The only way ICT can be employed to meet the educational

requirements of a digital era is by ensuring that ICT in education is underpinned by sound pedagogical principles aimed at improving the quality of teaching and learning (Bahati, 2011). As noted by Cuban (2009, p. 44), “the real promise of technology in education lies in its potential to facilitate fundamental, qualitative change to teaching and learning”.

One of the justifications for introducing ICT into education in the early 80’s was pedagogical. It was hoped that ICT would transform traditional education by solving issues classified as problematic. However, about three decades afterwards, the aim of transforming educational practices with particular reference to teaching and learning has not been fully achieved. For instance, in the UK, there was a significant increase in the use of computers in the classroom but rarely has the pedagogic expertise of teachers in the classroom been able to transform the classroom practice. Employing ICT to further educational goals necessitate the development of different theories, pedagogies, and approaches to teaching, learning, assessment, and organisation (Veletsianos, 2010). In other words, there is a need for a complete and effective change to the classroom pedagogy of teachers. Teachers need to re-examine the lesson's purpose, the nature of the task that should be set, and the method of assessing how learners carry it out (Lim et al., 2013).

ICT integration theories such as Rodgers’ diffusion of innovation, TPACK, and SAMR (Substitute, Augmentation, Modification, and Redefinition) have been employed in explaining the required knowledge combinations teachers need to integrate ICT effectively into their teaching practice. Kihoza et al. (2016) found that more than fifty per cent of the study's teacher trainees reported being unprepared to integrate technology into their practice. The participants in the study possessed low pedagogical ICT competencies compared to the requirements for effective ICT integration. Pedagogy involves ways of knowing and ways of doing; it is centrally concerned with how we understand practice (the “evidence base” of theory), and how we apply that theoretical understanding in practice (Beetham & Sharpe, 2013). Hence, the usefulness of the TPACK and SAMR frameworks depends much on the destiny of the professional teachers, their understanding of several ICT tools and what they can do to improve and increase the effectiveness of teaching practices. Teachers’ roles in the classroom change as a result of using ICT for teaching and

learning. However, I argue that the form and extent of change depend on the context in which the change occurs.

Despite government initiatives to invest in plans, policies, strategies, and equipment to transform Rwandan classrooms into SMART ones, no significant progress has been made. This lack of progress is because the teachers responsible for implementing and concretising the plans are “ill-prepared”. There is not much to show in respect of transformed classroom pedagogy, especially in Rwanda, as teachers are yet to fully engage with ICT in their classrooms and maximise its potentials. Three different studies have documented that ICT is underutilised in Rwandan classrooms (Ndayambaje & Ngendahayo, 2014).

The teaching profession is not only restricted to teaching new subjects or following the school curriculum but is an extension of developing pedagogical roles (Kalogiannakis, 2010). ICT use in the classroom allows teachers to feel more like facilitators rather than information givers. This develops 21st century 4C competences in learners such as critical thinking, collaboration, creative and communication skills because when learners use technologies in learning, they are highly engaged as they have an opportunity for discussion, reasoning and interpretation (Lawrence & Veena, 2013). This confirms the speculation of Wilson-Strydom et al. (2005) that pedagogical practices might need to be transformed for the benefits of ICT in education to be fully maximised. ICT allows new forms of teaching and learning to take place; however, it cannot ensure that effective and appropriate learning outcomes are achieved.

2.10 Summary of literature findings: Identifying the research gap

One important thing worthy of note is that ICT does not exist in isolation; it is interconnected with the rest of the environment. Hence, as opined by Tondeur et al. (2018, p. 39), research studies need to focus on “the whole configuration of events, activities, contents interpersonal processes taking place in the context in which ICT is used”. In response to this, a growing body of research on the local and international scene has investigated the link, connection or relationship between teacher preparation programmes and classroom practice regarding ICT integration and use.

Teachers are hotly debated in technology integration in education (Agyei & Voogt, 2014; Baran et al., 2019; Cuhadar, 2018; Tondeur et al., 2017). Various studies have examined the phenomenon from different dimensions, including the role of teacher educators (Tondeur et al., 2019), strategies of implementation of the programme (Burns, 2011), the focus of the curriculum (Beetham & Sharpe, 2013), usage of ICT tools for preparation and more importantly the effectiveness of programmes in preparing teachers for expected pedagogical changes required in their classrooms. However, these studies have investigated or focused on individual aspects as separate factors rather than examining them as components that make a comprehensible whole. Based on findings from several studies conducted in different contexts on the most effective strategies to prepare teachers for technology integration, two major strategies seem dominant across all programmes. These are teaching ICT as separate stand-alone courses in computer applications or educational technology courses and the infusion of ICT across the curriculum to encompass all subjects. The latter seems to have been accepted more widely among many countries for ICT to be implemented across the curriculum in teacher preparation programmes. In other words, all subjects taught in teacher training now have some element of ICT infused into them. Furthermore, many longitudinal studies had rather small samples to justify the population size. In such situations, there are several possibilities of other factors influencing the results, thereby interfering with the validity of the findings of such studies.

Achieving a pedagogical transformation in classroom practice demands more from teacher preparation than training teachers on how to use tools; it requires a crystalized understanding and appreciation of the complex interrelationships between artefacts, users, tools, environment or context and eventual practices (Agyei, 2013). Acquiring ICT skills alone is insufficient; using ICT to enhance teaching and learning processes is the key to achieving effective pedagogy-technology integration. However, the major challenge has been how these two can be combined (Majumdar, 2015). Hence, a holistic, systemic perspective is required to understand how teacher preparation programmes' experiences may change teachers' pedagogical practices in the classroom.

Research has emphasised that teachers as learners should be allowed to have quality technology experience for them to replicate the same in their classrooms (Brown, 2017;

Voogt et al., 2013). Additionally, research has identified that quality technology experiences and training provided in teacher preparation programmes is a critical factor in influencing the use of ICT in their future classroom (Agyei & Voogt, 2011; Drent & Meelissen, 2008; Stobaugh & Tassell, 2011; Tondeur et al., 2012). Therefore, how teachers acquire the skills they need to use technologies, how the technology is actually used, and to what ends are critical domains that must be carefully explored (Lawrence & Veena, 2013). However, extant literature continues to highlight a lack of preparedness of teacher trainees concerning the appropriation and integration of ICT for pedagogical purposes (Bakir, 2015; Tondeur, van Braak, Siddiq, & Scherer, 2016).

A large percentage of studies report that using ICT in the classroom is basically for administration, record keeping, and sending and receiving emails. In other words, teachers' practices focus more on computer skills rather than integrated learning intentions, and often teachers' practices relate more to issues of management and organisation than to learning and teaching. Subsequently, it can be observed that teachers still do not exploit ICT for new and improved teaching approaches. Furthermore, many studies identified were conducted in developed countries with more of the focus on preservice teachers (Cuhadar, 2018; Sang et al., 2010; Svenssona & Baelob, 2014; Tondeur et al., 2012; Valtonen et al., 2015). Very few have focused on in-service teachers (Abuhmaid, 2011; Kalogiannakis, 2010; Mahmud & Ismail, 2010; Thorsteinsson & Page, 2008), and even these few studies have examined the construct from a professional development perspective.

In the Rwandan context, no study was found on in-service teachers (teacher-learners) and their learning experiences in an ICT-enabled environment or how this may affect their future use of ICT in the classroom. The few studies found focused on computer use in the classroom (Hakizimana, 2015), the experience of teachers in professional development training, ICT integration in higher learning institutions (Karunaratne & Byungura, 2017; Ndayambaje & Ngendahayo, 2014), and challenges of introducing ICT into schools (Hakizimana, 2015; Karunaratne & Byungura, 2017; Ndayambaje & Ngendahayo, 2014; Rubagiza et al., 2011; Rutaisire, 2012).

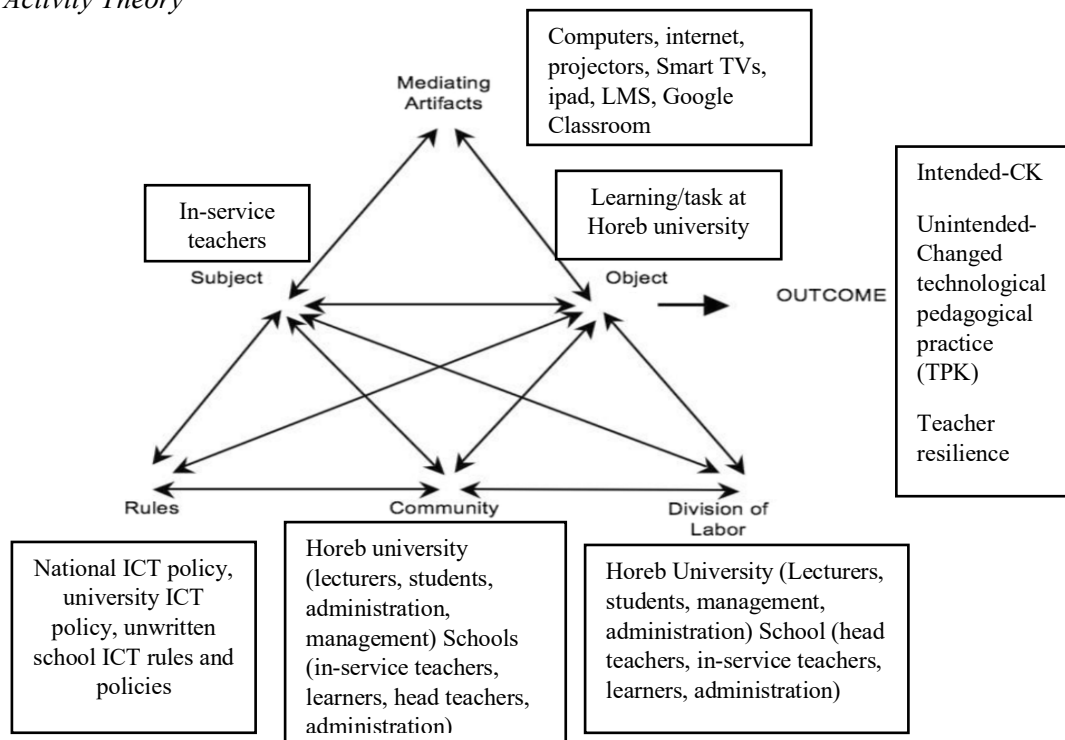
There is a paucity of literature that investigates the learning experiences of in-service teachers in Rwanda and how this may impact their classroom practice. Based on this premise, my research departs from the existing literature to investigate the experiences of Rwandan distance in-service teachers as they navigate the ICT learning environment. The research study produces an in-depth account of the interaction with technology that facilitates teachers' learning, which could influence their decision to use technology in their own classrooms and determine how and why technology is used in the classroom.

2.11 Theoretical framework

The theoretical framework has been described as the most crucial aspect of any research process. The theoretical framework serves multiple purposes, such as the foundation on which all knowledge is constructed and the structure and support for the rationale of the study (Osanloo & Grant, 2016). According to Simon and Goes (2011), a good theoretical framework helps the reader to comprehend the researcher's perspective, thereby establishing that the proposed investigation is based on empirical facts from sources that are trustworthy. The strength of activity theory is that it affords a holistic description of an activity system in terms of its basic components and interrelations. Hence, this study employed activity theory, as depicted in Figure 2.1, as a framework to provide a holistic view to explore the phenomenon at hand.

Figure 2.1

Activity Theory



(Engerstrom 1987)

Activity theory has its roots in the classical German philosophy of Kant and Hegel, which emphasised the historical development of ideas and humans' active and constructive role. This philosophy provided the foundation for the more contemporary philosophy of Marx and Engels and the Soviet cultural-historical psychology of Vygotsky, Leont'ev, and Luria (Kuutti, 1996), on which activity theory is based. According to Hashim and Jones (2007), activity theory has been recognised by researchers as being holistically rich in terms of understanding how people do things together with the assistance of sophisticated tools in intricate and dynamic environments. AT also provides a useful paradigm for understanding how human experience, needs and creativity shape the design and effectiveness of ICT. Activity theory is commonly used to study, analyse, and interpret the changes required to transform collective practices in institutions, organisations, and other activity systems (Karasavvidis, 2009). Therefore, the application of AT for the study of ICT within teacher training and classroom contexts appears to hold great promise. Activity theory insists that an activity is mediated by tools, which helps to explain relationships between the user and the tool. If ICT is assumed to be a cultural tool, then it is imperative to be able to ask and

answer questions connected to how these tools facilitate learning, and how lecturers', teacher-learners' and students' ICT use are transformed over time.

Activity theory can be used to comprehend the transformation process within a system, such as a classroom, and to demonstrate how different systems interact and transform over time (Engestrom, 1987). It is essential to note that an activity cannot be comprehended or analysed outside of its context. Therefore, when analysing human activity, we must consider the types of activities people engage in, who engages in them, their goals and intentions, and the objects or products that result from the activity. Therefore, an analysis of the components of the AT model is required, as it provides a clear picture of the complexity of the activities involved in the integration of ICT into teaching and learning in university and school settings. According to Leont'ev (2005), an activity is prompted by a motive such as a need. Therefore, an activity consists of one or more actions that, when completed, fulfil the initial purpose. The in-service teacher participants represent the subject in this study. In-service teachers are characterised as unqualified or underqualified teachers already in employment in the education sector who desire to further their education to obtain the required qualification according to the standards in Rwanda. The participants in this study enrolled in the university to obtain this qualification to satisfy the minimum requirement to qualify as teachers. Before enrolling at the university, the in-service teachers' qualifications ranged from Teacher Training College (TTC) certificates to Diploma certificates obtained from the Colleges of Education.

The Activity Theory model states that activities within the system are directed at the object. Therefore, the object in this study refers to the in-service teachers' learning experiences within the university context. The object provides the activity with direction and identity (Sannino & Engeström, 2018). Enrolling at the university for further learning required the in-service teachers to attend lectures, complete tasks such as assignments, group work and in-class presentations among others. Their learning involved undertaking cognitive and mentally challenging activities to acquire knowledge and skills useful for carrying out daily responsibilities as teachers. The artefacts (ICT tools) used in learning mediation at teacher training institutions include computers, the internet, learning management systems, multimedia projectors, and Web 2.0 tools, among others. These ICT tools aid

communication, collaboration and engagement with learners and allow access to learning material and resources.

The community, as the particular context in which activities and all the component actions are performed, significantly determines the conditions under which the initial motive can be satisfied. Horeb university and the schools where the in-service teachers were employed constituted the two communities in the context of this study. Activity Theory defines the division of labour as a component that refers to “who does what”, with reference to the object (learning) within the Horeb university context and outcome (pedagogical practice) in the school context. In the current study, labour is distributed among the teaching faculty or lecturers, in-service teachers, head teachers and the Ministry of Education. Rules include national ICT policies, school-level ICT policies, and institutional ICT policies.

- **Relevance of activity theory to this investigation**

Several studies in the field of education have found AT quite useful and effective in explaining phenomena related to learning with ICT (Bligh & Flood, 2017). The AT views human interaction as mediated by tools within particular contexts. Activity theory has been used to collect, analyse, and interpret data on the transformation of collective practices within different contexts. Activity theory is relevant to this investigation because its tenets can accurately represent the configuration of the actors and events under investigation in this study. Therefore, it allows for each tenet to be considered individually and as part of a whole system, thereby providing a comprehensive grasp of the interrelatedness and interdependence of the elements within the activity system. The subject (in-service teachers) engage in the use of mediating artefacts (ICT tools) to execute their learning (object) with the expectation of achieving improved content knowledge (outcome) in their different areas of specialisation as teachers. Their dual status as in-service teachers and learners placed them significantly as actors in two different contexts. While they perform their duties as teachers within the context of the schools where they are employed, they must also fulfil the responsibilities attached to their student status at the university.

Furthermore, the communities (the university and the schools where the in-service teachers were employed) were a determinant factor regarding the outcome of in-service teachers’

engagement in different learner activities. Charbonneau-Gowdy (2015) emphasised the alignment of roles between teacher training institutions and the schools as communities in fostering teacher trainees' development and use of 21st century teaching approaches. The existing policies and guidelines (rules and regulations) in the different contexts also played an important role in shaping the activities the in-service teachers (subjects) engaged in in this study. Division of labour as a tenet of activity theory provided a deeper understanding of how taking up responsibilities hinders or aids effortless functioning within the school and university contexts.

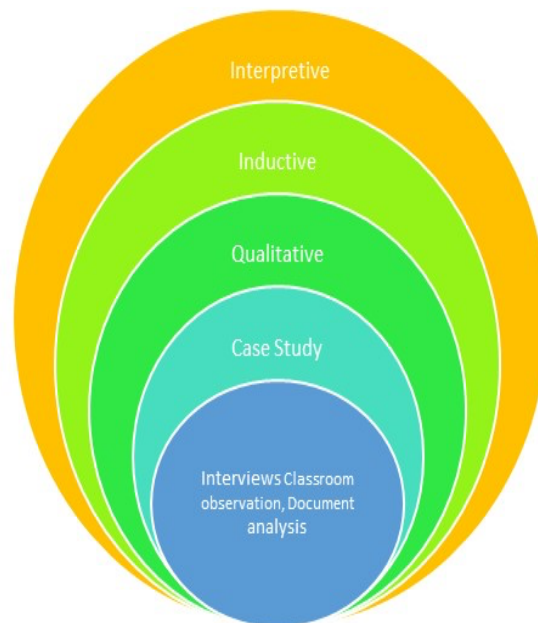
3 CHAPTER THREE RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

Methodology uncovers the basic assumptions upon which the research is hinged and accounts for the belief system held by the researcher. This chapter targets this task to substantiate the integrity of the whole research process. An appropriate research methodology is central to the success of any research study. I, therefore, approached the methodology in a manner that strives to ensure that it is suitable for the research objectives and questions posed by this investigation. This study is an endeavour to explore and have better insights on how in-service teachers interact with ICT for learning and how this experience may impact their classroom practice. Therefore, I seek to elucidate the research design chosen, rationalise the methods I employed for collecting data, and give a detailed description of the procedure for data analysis (Creswell, 2017; Maxwell, 2012). I adapted the research onion (Saunders et al., 2009) to present this section graphically to achieve more coherence.

Figure 3.1

Research Onion



(Saunders et al., 2009)

The chapter is sequenced as follows: first is an introduction to the underlying paradigmatic assumptions that underpin the study. The choice of a research paradigm reflects my worldview as a researcher and guides my appropriate methodological approach for this study. I then provide a detailed discussion of the research methodology that guided my work; after that, I describe the case study method of enquiry used in the data collection, the pilot study, and the data sampling methods employed. I give a detailed description of the profile of participants (in-service teachers) and the research sites' school context. Issues of trustworthiness, namely, reliability, dependability, confirmability, and credibility, are examined. The chapter then concludes with a summary. The table below depicts the research strategy applied in this investigation.

Table 3.1

Outline of the research strategy

Paradigmatic Assumptions	
Meta-theoretical paradigm	<i>Social constructivism</i>
Methodological paradigm	<i>Qualitative exploratory research design</i>
Strategy of inquiry	<i>Case study</i>
Selection of Cases	
Purposive sampling	<i>selection of eight (8) in-service teachers comprising of three males and five females from Horeb University (pseudonym)</i>
Data Collection	
Data Collection methods	<i>Semi-structured interview, classroom observation, document analysis</i>
Content analysis	<i>Content and thematic analysis</i>
Quality Measures	
Credibility, Transferability, Dependability and Confirmability	
Ethical Consideration	
<ul style="list-style-type: none"> • <i>Informed consent obtained from all participants</i> • <i>Attention to issues of respondents' privacy, confidentiality and anonymity</i> 	

3.2 Paradigmatic approach

The choice of a philosophical position concerning the phenomenon to be studied precedes the actual conduct of a research study. This position has been described by Creswell (2017, p. 5) as the “general philosophical orientation that a researcher brings to a study”. A philosophy can be interpreted as a combination of beliefs, principles, and aspirations that underlie a person’s conduct or practice in a given context (Creswell, 2003). It is important for me as a researcher to reflect on and clearly understand the philosophical worldview assumption that guides my study and the design and procedures to be employed. The philosophical stance illustrates the rudimentary beliefs guiding my actions as a researcher. This is usually revealed in how I discern reality (ontology) and connect it to ways of knowing (epistemology) to create meaning. Researchers vary in the choice of a paradigmatic approach because of the different ways in which individuals view the world; this usually dictates the selection of suitable strategies to observe and evaluate the phenomenon under study. In the following sections, I will discuss my meta-theoretical worldview, which dictated my choice of a methodological paradigm.

3.2.1 *Meta-theoretical paradigm*

A research paradigm has been described as the researcher's worldview, which defines the thinking, school of thought or perspective that informs the meaning of research data (Creswell, 2017). It is the conceptual lens through which the researcher examines the methodological aspects of their study to determine the appropriate research methods to be used and how data would be analysed. According to Guba and Lincoln (1994), research methods' issues are secondary to paradigmatic questions in that the paradigm (which is the researcher’s worldview) guides the investigator in the choice of methods. I, therefore, focus this discussion on the epistemology that I associate with, which in turn provides the conceptual roots and forms the basis for my study. In another opinion, Bassey (2003) described a research paradigm as a network of articulated ideas relating to the nature of the world and the research objectives. When a researcher follows it, it shapes their thinking and provides a foundation for their research actions (Lincoln et al., 2011).

As a researcher, I affiliate with the constructivist school of thought. The justification for this is that “constructivists believe in pluralistic, interpretive, open-ended and

contextualised perspectives towards reality” (Creswell & Miller, 2000, p. 125). Within the constructivist paradigm, I acknowledge and embrace the understanding that an inherent subjectivity is involved when working with human beings. “Thus, the researcher must explore the subjective conceptualisations of reality that citizens of a particular social context have constructed by engaging, through the community eye, in the lived experiences of the people” (Lincoln et al., 2011, p. 106). I find this paradigmatic approach appropriate for my study because I accept that there are variations in how people interact and respond to different circumstances or situations. Knowledge construction is an individual endeavour and therefore holds different meanings for different people. I believe that the ICT experiences of in-service teachers in different contexts would not be the same because of the different factors that occur in their daily lives related to studying, teaching and learning. Therefore, I intend to interpret or make sense of my participants' meaning of their world (Creswell, 2014). My research aims to learn as much as possible from participants' views of the phenomenon under study.

3.2.2 *Methodological paradigm*

Methodology involves how the researcher may utilise specific tools in the journey to uncover new knowledge (Hammond & Wellington, 2012). As earlier stated, this study is located within the constructivist paradigm. According to Adom and Ankrah (2016), constructivism facilitates understanding the complex and multiple natures of phenomena. Similarly, it contributes to comprehending the human condition in different contexts (Bengtsson, 2016). This study will collect data from a natural setting without any influence or manipulation of the data and in the context where these experiences are lived, and as such, will be qualitative. Qualitative research can explore influences that are too complex or delicate to be captured through structured methods (Ritchie et al., 2013). Green and Thorogood (2018) argued that qualitative methods reach parts that other methods cannot reach, particularly in research focusing on the connection between process and outcome.

This study is focused on how ICT as a tool of instruction for in-service teachers may influence their classroom practice and learning, which can be taken as a process, and the influence it has on their practice, which is the outcome of their interaction with ICT. A more elaborate explanation has been supplied by the Activity Theory in the previous

chapter. Employing a qualitative approach demanded prolonged and intense contact with in-service teachers in their everyday situations and provided a holistic view through the participants' own experiences, words and perceptions of how they understand, account for and act within these situations (Miles et al., 1994). Research evidence shows that qualitative methodologies provide a contextual understanding of the phenomena under study (Adom & Ankrah, 2016; Guba & Lincoln, 1994). The choice of methods largely depends on the research problem or what the researcher is set to investigate or explore (Silverman, 2013a).

My interest as a researcher lies in exploring how in-service teachers studying at a university in Rwanda experience ICT in their learning process and how it could translate to their changed classroom pedagogy. A constructivist paradigm is deemed a qualitative methodology fit for my study because I want the voices of my participants to be heard to allow them to describe their feelings, thoughts, frames of reference, and experiences in their own words (Yilmaz, 2013). I wanted to avail an avenue to them to express themselves and to demonstrate their lived experiences of their own learning and how technology may shape their classroom practice. In this regard, I chose a case study design, as the method of enquiry provides answers to my research question. An important rationale for my choice is that case studies acknowledge the particular research context, study aims, methods and overarching research paradigm of this particular research study.

3.3 Research purpose

The purpose of this case study was to explore the experiences of in-service teachers as they navigate their learning with ICT in a university and how this may transform or change their classroom pedagogical practices. I chose an exploratory research design for this study (Baxter & Jack, 2008; Creswell & Poth, 2017). The main reason for the choice was that I desired to attain a new and deeper understanding of how in-service teachers construct knowledge, which may be determined from their experiences as they interacted with ICT for learning in the lecture rooms and teaching in their classrooms. Case studies are used in exploratory research because they can help us generate new ideas that might be tested by other methods (Baxter & Jack, 2008). They are an important way of illustrating theories to reveal how different aspects of an individual's life are connected. This was achieved by

using an open, flexible and inductive approach to understanding how participants constructed their experiences (Creswell & Poth, 2017). The study was limited to eight in-service teachers, who were also students studying at Horeb university in Kigali, Rwanda at the time of this study.

3.4 Strategy of inquiry

The strategy of inquiry, also referred to as approaches to inquiry, serves to advance distinct directions for procedures in research design (Creswell, 2008). A researcher is involved in designing a research study by identifying the problem, formulating the research questions, selecting the cases to be studied and identifying the participants. For this study, the case study approach was the strategy I adopted. This approach is underpinned by the belief that naturalistic qualitative studies are particularly beneficial to studies in the social sciences and education. Qualitative studies have the unique ability to capture the participants' subjective realities and understand complex situations in specific contexts (Bassey, 1999). In the following section, I attempt to discuss the approach employed in this study.

3.4.1 Case study

By definition, a case study approach is a research strategy that “arises out of the desire to understand complex social phenomena” (Yin, 2003, p.2). The rationale for a case study approach has been argued by Silverman (2013a) as the ability to allow researchers to generalise to theoretical propositions, sample social relations, test theories by choosing extreme cases, and choose new cases during the research process, provided it is useful. The case study approach allows the researcher to preserve real-life manifestations' complete and meaningful features. Furthermore, case studies have been identified by Starman (2013) as one of the earliest types of research approaches to be used in qualitative methodology and significant research involving education. Starman (2013) argued that case studies have the potential to achieve high conceptual validity and the ability to uncover new variables as well as generate new hypotheses inductively.

According to Yin (2003), questions are better answered through case studies as such questions “deal with operational links needing to be traced over time, rather than mere frequencies or incidence” (Yin, 2003, p. 9). Therefore, I considered a case study appropriate for this enquiry because it describes the lived experiences of in-service teachers

on how ICT may be influencing their classroom practice. Stake (1995) identifies instrumental case studies as studies employed in situations where the aim is to accomplish something other than understanding an individual or group. The current study focused on the phenomenon of how the learning experiences with ICT may transform the classroom practice of in-service teachers. Therefore, through an instrumental case study, I endeavoured to explore teacher participants' experiences to gain insight into their ICT use and its potential teaching transformative effects.

Like all case studies, instrumental case studies offer a thick description of the particular research site and participants. This case study will use different data collection techniques such as interviews, classroom observation, a research journal, and document reviews to collect qualitative data. Case studies also provide more flexibility during data collection (Baxter & Jack, 2008). I was guided by my experiences in the field during data collection to dictate the level of researcher reflexivity.

3.5 Research methodology

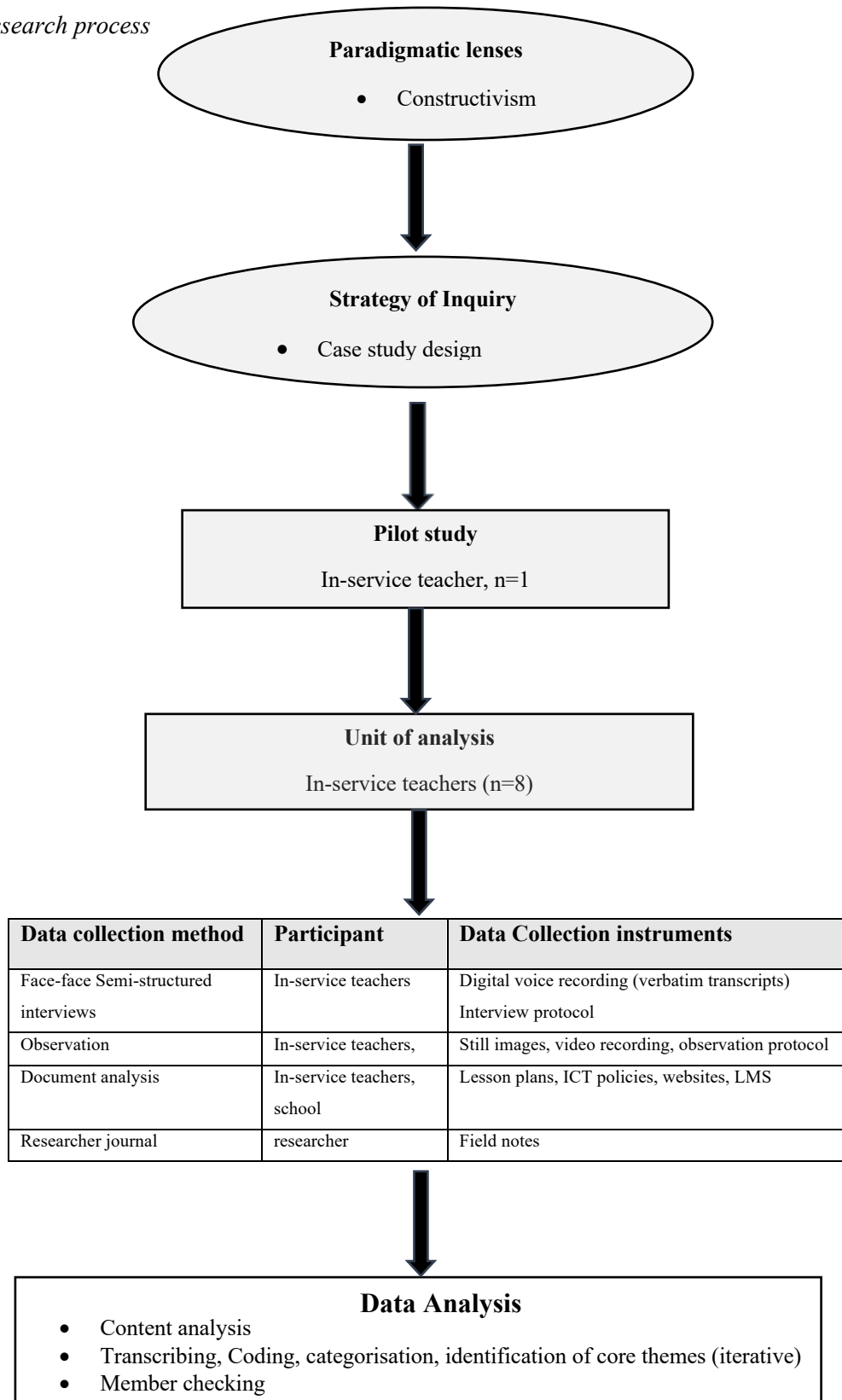
Research methodology has been described as the blueprint or master plan that guides the researcher in mapping out an approach to solving a particular problem (Jamshed, 2014). The methodology describes the various steps researchers adopt in studying their research problem and the logic behind it in detail (Kothari, 2004). This study adopted purposive, snowball and convenience sampling. Purposive sampling is particularly useful to this study because I focus on describing a phenomenon about which little is known. Therefore, I included the participants that could provide me with the best information to achieve the objectives of my study (Kumar, 2019; Yin, 2003). I selected the information-rich cases that could assist me in understanding the research problem and questions (Creswell, 2014).

3.5.1 *The research process*

The research process followed in this study is described in Figure 3.1 and elaborated upon in Section 3.5.2.

Figure 3.2

The research process



3.5.2 *Selection of research sites*

The researcher approached the participants and participant schools for this study individually through face-to-face meetings and phone calls. The purpose and aim of the study were carefully explained to them, after which they signed a consent form to indicate their willingness to participate. In the selection process, the schools that gave their consent all happened to be primary schools. While some were private, others were public schools, meaning the government owned them. Stake (2008) suggests that the selection of cases should provide an opportunity for the researcher to learn. Therefore, this study utilised numerous research sites, Horeb University, and the respective schools where in-service teachers were currently employed were purposefully selected. The sites were selected with the belief that they would offer rich data needed for my study. The selection of participants determined the selection of sites because the sites included schools where the participants worked. I formulated some criteria on which I hinged the inclusion of the sites in the study.

- **Participants' schools**

Firstly, I wanted to choose schools with teachers also studying at Horeb University. This qualifies them to be an integral part of the process that I explored, namely, the possible transformative effect that learning through ICT may have had on their classroom practice. I initially planned to choose two in-service teachers from each school, but it soon became evident that this might not be possible. The major factor responsible for this was contract-based employment in Rwanda. Employees are given renewable job contracts for a certain period, ranging from six months to two years. Therefore, an in-service teacher's contract may expire during the ongoing research. Another reason was the teachers' constant search for better opportunities, making in-service teachers frequently migrate between schools. I eventually selected one in-service teacher, each from six different schools, and two from another, which comprised eight in-service teachers.

Secondly, the schools should have adequately equipped ICT laboratories with fully functional computers, and constantly used for teaching and learning. Schools should be equipped with ICT tools like desktop computers, One-Laptop per-Child Laptops (OLPCS), or Positivo laptops (Positivo laptops were custom-made for teachers by the Rwandan

government). The most important thing was for them to be functional to ensure that ICT-related teaching and learning activities were properly facilitated.

Thirdly, in-service teachers needed to possess basic ICT skills and be employed in schools that supported them in using ICT for teaching and learning.

- **Higher education institution**

The HEI was selected based on the following criteria:

The HEI must offer teacher education through distance learning (in-service mode). The participants (student in-service teachers) must have studied part-time through distance learning at Horeb University as they had permanent teaching responsibilities. The HEI had to be equipped with adequate ICT facilities like computers, projectors or smart televisions, internet access, and ICT laboratories.

Finally, the institution should have a functional online platform for teaching and learning where the in-service teachers can support the face-to-face sessions with online interaction with their lecturers. The criteria mentioned above were satisfied by the sites included in the study, therefore a detailed description of these sites is deemed necessary. I will begin with the HEI. In Rwanda, education institutions are either owned by individuals and non-governmental organisations or by the government, the latter being referred to as public and the former as private for this study.

3.5.3 Research sites

3.5.3.1 Horeb University

The HEI in this study was a University situated in the Kicukiro⁶ district in Kigali, Rwanda, situated in the Eastern part of Africa, hereafter referred to as Horeb University. Horeb University is a private university that was established in 2012. It is one of the universities offering teacher training programmes through distance learning. Initially, the university offered courses focused only on business and accounting to students interested in corporate courses. However, it later included education courses due to demand from the government to upgrade and train the underqualified or unqualified teachers working in Rwandan schools. The institution has a reputation as one of the best and leading institutions in teacher

⁶ Kicukiro is a municipal district in Kigali

training, according to audit reports generated from several audits by the Higher Education Council (HEC) of Rwanda. Horeb University is regarded as one of the institutions that is relied upon by the nation of Rwanda to train teachers who are well grounded in practice and equipped with the 21st century skills required in the classroom that is envisioned by Rwanda by 2035.

While many other universities operate in rented facilities, often located in noisy and unsuitable places, Horeb University is housed in a spacious purpose-built facility with a serene environment suitable for learning. The four-storey building is divided into two wings, containing different faculties, offices, laboratories, student hostels, and lecture rooms. There are five faculties, namely, Public Health, Business and Social Sciences, Nursing, Pure and Applied Sciences and Education, where students are trained in specific programmes and equipped with the required skills to prepare them adequately for the job market. The lecture rooms, located in the right wing on the first floor, had a sitting capacity of a maximum of six hundred students and a minimum of eighty students per lecture session. All lecture rooms are fitted with Smart Televisions and internet connectivity. In addition, there is a basketball court and a swimming pool, which students can use at will. At the time of the study, there was a student population of about three thousand students enrolled in different programmes, including education.

The vision of Horeb as an institution of higher learning is to be a global centre of excellence in education and research. This is in line with achieving the goal of shifting to a knowledge-based economy by 2020, as contained in the policy document “Vision 2020” of Rwanda (Rwanda, 2012). Horeb university invested in modern, adequate and functional tools, equipment, and facilities to meet this goal. These included five ICT laboratories of various categories (hardware and software), four science laboratories, and two nursing skills laboratories, all dedicated to serving students and meeting their research, study and other ICT-related needs. The student population is approximately three thousand students, of which about eight hundred are education students from the school of education. Faculty members comprise both full-time and part-time staff. There are about forty permanent lecturers and thirty temporary (part-time) employed lecturers.

3.5.3.2 Schools

The other research sites constitute the schools in which the in-service participants practice. These include most primary schools in the province of Kigali. The schools are equipped with ICT infrastructure, and teachers use them regularly. I allocated pseudonyms to individual schools as a means of anonymity and to provide easier identification for clarity in the discussion of the results in the subsequent chapters. It is important to give a brief description of each school to paint a mental picture of each school context, so I profiled each of the participant schools.

Holiness school is a private primary school located on a hill in the Nyarugenge⁷ district of Kigali, about two kilometres from the city centre. The purpose-built facility sits in a large compound with a football field and a playground with different types of swings for the learners' use. It has a total of four blocks containing twenty classrooms, while another block under construction was intended to serve as the school hall and dining room. Near the playground was a kitchen where meals were prepared to feed the learners breakfast and lunch. One library was fitted with a Smart Television, and two computer laboratories with about twenty-two units of desktop computers altogether. In addition, two multi-media projectors and a mobile projector screen, usually moved from class to class as the need arose, were used for all ICT-related learning activities. Furthermore, two loudspeakers, three photocopiers, and three printers were among many other ICT tools used in the school. The staff population comprised twenty-six members, including the head teacher. The school had six hundred and sixty learners in different grades ranging from Nursery One to Grade Six. The National Curriculum of Rwanda, also known as the Competency Based Curriculum, was adopted to train and educate the learners.

Lower Kanazi, also a private primary school owned by a group of missionaries from the United States of America, is about located about four kilometres from the city centre. It was established in 2015, and caters for the needs of learners, such as uniforms, shoes, stationery, and feeding for free. It had two sectors of twelve classrooms, while there here was a separate block containing the administrative office, a skills acquisition centre, and the ICT laboratory cum library. The library was fitted with Wi-Fi connectivity that supplies

⁷ Nyarugenge is a municipal district in Kigali

the school internet, and it is open access. The twenty members of staff included five administrative staff members. Lunch is provided for the learners from a kitchen located some metres away from the football field. Furthermore, the ICT tools available in the school include fifty XO laptops, fifteen Chrome laptops, two printers, three speakers, and two photocopy machines. There is one multimedia projector and a projector screen to facilitate its use. A total number of four hundred and fifty learners were distributed across the classes from Nursery One to Grade Six. Similar to Holiness school, this school also utilise the Competency-Based Curriculum as approved by the Rwandan Ministry of Education.

Success school is situated in the Gasabo⁸ district of Kigali, in the heart of the city, consisting of a group of schools, with the secondary and primary sections in the same location. The school operated in a rented building; some classes were small and not well-ventilated. However, there were plans to move to a more spacious and permanent place in the future. There was a huge dining hall, as the school also provided lunch for the learners and staff. The ICT laboratory was located in a small room with poor lighting, with about ten laptops. Each teacher also had their own personal computer, which they used for the preparation of notes, record keeping and teaching. This school's major source of internet access is personal modems bought and subscribed for by individual teachers. In Success schools, the responsibility for internet access was at the teacher's discretion as the administration had not implemented any measures to ensure general access to the internet. The school had private ownership, and the Cambridge Curriculum (British Curriculum) was adopted for learning. The school had learners from Nursery One to Grade Twelve. There were thirty teachers and nine hundred and thirteen learners.

Great Oaks school is another private primary school dedicated to serving about one thousand-five hundred learners between the ages of three and twelve years. It is owned by a group of women who came together to provide education to the Rwandan populace. It is located within the city and is about two kilometres from Success School. Previously, it operated in a rented apartment with small and overcrowded classrooms but soon relocated to its own site, with a new purpose-built building. There were ten beautifully decorated and

⁸ Gasabo is one of the municipal districts in Kigali

child-friendly classrooms, an ICT laboratory, and a library. There was also a big modern kitchen with all the equipment to facilitate feeding of the learners twice daily. The total number of staff was nineteen, including the administrative staff, while the learner population was four hundred and thirty-five. Internet access is supplied by Wi-Fi, and the teachers also have personal computers which they work with. Something different from the other schools mentioned earlier is that this school allowed their learners to bring their own ICT devices to school, so they could use them in the classrooms for learning purposes without having to move to the computer laboratory. The ICT tools used in the school included two photocopy machines, two loudspeakers, and fifteen laptop computers owned by individual teachers. The Cambridge Curriculum was also adopted there as well.

Upper Kanazi school is a public school owned and funded by the Rwandan government. It is also a group of schools with both primary and secondary schools in the same location. Situated in a serene environment about three kilometres from the city centre, it had about eight blocks of classrooms, with each block housing three classrooms. A block near to the entrance contained two Smart Classrooms (ICT rooms) and a library. There were fifty-three teachers and two thousand three-hundred learners in all. Two hundred XO (OLPC) laptops were provided by the Ministry of Education, while there were about fifty Positivo Laptops. The school adopted Competence-Based Curriculum, being a public school. This school had a distinguishing factor as it operated two learning shifts. While some learners attended the morning school between 7:30 am and 12:00 pm, others attended the afternoon shift.

Peace Academy consists of a group of private schools owned by missionaries from the United Kingdom. It is located in the Kicukiro⁹ district of Kigali, in a quiet suburb. It accommodated the primary and secondary schools together in the same space. The spacious and well-ventilated classrooms were all fitted with projectors and whiteboards. In this school, unlike the others, the projectors were static, meaning it was always available for the use of any teacher at any time. The Competency Based Curriculum guided their teaching and learning activities. The school served learners between the ages of three and twelve and had classes from Nursery One to Grade Nine. The environment is beautiful,

⁹ Kicukiro is a municipal district in Kigali

and far away from the hustle and bustle of the city centre. The staff population is eighteen teachers, while the learner population is two hundred and eighty. There were four blocks of classrooms, with a total of twelve classrooms. In addition, the school had a playground which also served as a football field.

Jambo Primary School is a private school owned by an individual educator with a vision to place the school on a pedestal of quality delivery of teaching and learning facilitated through the use of ICT. The school is located in the eastern part of Kigali, in a beautiful and quiet environment. The school also adopted the Competence-Based Curriculum. The school was equipped with six multimedia projectors, thirty laptops, three printers and one scanner. Additionally, two digital cameras and one loudspeaker were available to facilitate teaching and learning activities. The school had two hundred and ninety-five learners and fifteen teachers. The school served learners from Nursery one to Grade Six.

Table 3.2

Summary of research sites

School	Institution Type	Learner Population	ICT Facilities	Internet Access	Curriculum
Horeb University	Higher Institution	3000	Five ICT labs, two hundred computers, twenty smart TVs, fifteen projectors	Wi-Fi	Module-based
Holiness School	Primary	660	One ICT lab, two projectors, one projector screen, twenty desktop computers	Wi-Fi	Competence-Based
Upper Kanazi School	Primary	2300	Two hundred Positivo Laptops, Fifty XO Laptops, One projector, One photocopy machine	Wi-Fi	Competence-Based
Lower Kanazi School	Primary	450	One photocopy machine, two printers, fifteen Chrome Book laptops, fifty XO Laptops, one projector, and a projector screen	Wi-Fi	Competence-Based
Success School	Primary	913	Two photocopy machines, ten laptops, two printers, and two projectors	Wi-Fi	Cambridge
Great Oaks School	Primary	169	One photocopy machine and fifteen laptops,	Personal modems	Cambridge
Jambo School	Primary	295	Six projectors, thirty laptops, two photocopy machines, three printers, and one scanner	Personal modems	Competence-Based

School	Institution Type	Learner Population	ICT Facilities	Internet Access	Curriculum
Peace Academy	Primary	280	Twelve projectors, two photocopy machines,	two	Competence-Based

3.5.4 Selection of participants

Sampling has been described as the process or technique of selecting a representative part of a population to determine the characteristics of the whole population (Webster, 2008). I employed purposive (Patton, 1990; Suri, 2011), convenience, and snowballing sampling to accomplish this. Convenience sampling allowed me to select participants who met certain practical criteria, such as possession of basic ICT skills, accessibility, geographical proximity, and willingness to participate in the study. Some participants lived and worked in the districts of Bugesera¹⁰, and Rwamagana, which is ten kilometres from the capital city of Kigali. I used the snowballing technique, arguably the most widely employed method of sampling in qualitative research. In snowball sampling, the researcher accesses informants through the contact information that other informants provide. (Noy, 2008). Therefore, the first set of identified participants identified their colleagues who met the same criteria as they did.

Table 3.3

Demographic information of in-service teacher participants

Participant	School	Age (y)	Gender	Teaching Experience	Grades	ICT Skills	Teaching Subjects	Area of Study at Horeb University
Adeline	Upper Kanazi	23	Female	1	P5, P6	Intermediate	Science and Elementary Technology	Economics Entrepreneurship
Daudi	Holines	26	Male	4	P4	Intermediate	Science and Mathematics	Economics Entrepreneurship
Oreofe	Success	27	Female	4	P5	Intermediate	Science, Mathematics, English	English Literature
Longoria	Oaks	50	Female	6	P4	Basic	English and Literature	English Literature

¹⁰ Bugesera and Rwamagana are municipal districts within Rwanda

Participant	School	Age (y)	Gender	Teaching Experience	Grades	ICT Skills	Teaching Subjects	Area of Study at Horeb University
Sylvester	Jambo	25	Male	3	S1,S 2	Advanced	History and Geography	History Geography
Yvette	Lower Kanazi	25	Female	5	Nursery 1	Basic	All subjects	Biology Chemistry
Nyansani	Lower Kanazi	27	Male	6	P4,P 5, P6	Basic	Mathematics and Science	English Entrepreneurship
Divine	Peace Academy	30	Female	4	P5,	Basic	English	English Kiswahili

In qualitative research, appropriate sampling methods are concerned with the richness of information that may be obtained (Kuzel, 1992). This study is constituted of a total number of eight participants. Qualitative studies are concerned more about making meaning than generating hypothetical statements (Silverman, 2013a).

Considering the homogeneity of the cases, the principal participants in the study were eight teacher trainees (in-service), enrolled at Horeb University in Rwanda who were in the second year of study during March 2018, and were pursuing a three-year bachelor's degree in education. Yilmaz (2013) posited that “regardless of the type of unit of analysis, the main aim of purposeful sampling in qualitative research is to select and study a small number of people or unique cases whose study produces a wealth of detailed information and an in-depth understanding of the people, programmes, cases, and situations studied” (Yilmaz, 2013, p. 3). I justified this by handpicking the cases to be included and thus developed satisfactory samples concerning my needs. I approached the participants individually, providing a detailed explanation of my research. I then gave my participants time to make informed decisions by availing them with consent letters which contained all the information about what was requested of them as participants in the study.

In situations where the goal is not to generalise to a population but to obtain insights into a phenomenon, individuals, or events, then the qualitative researcher purposefully selects individuals, groups, and settings that increase understanding of phenomena (Onwuegbuzie

& Leech, 2007). Therefore, eight participants were drawn from the arts and science specialisations at the undergraduate level, comprising five females and three males.

3.5.5 Data Collection Methods

Qualitative research requires robust data collection techniques and the documentation of the research procedure (Bowen, 2009). By conducting interviews, classroom observations and document analysis as data collection techniques, I employed method triangulation in this study. Yin (2003) opined that the likelihood of accuracy and more convincing data increases when several sources of information are used, thereby increasing the construct validity. Through triangulation, findings from one source of data were checked against another from a different source. According to Denzin (2012), triangulation is a strategy that adds rigour, breadth, and depth to any inquiry; it is an attempt to ensure in-depth comprehension of the phenomenon. The data collection methods I employed are discussed in the following sections.

3.5.5.1 Pilot study

According to Van Teijlingen and Hundley (2001), a pilot study can be described as the pre-testing of an instrument; it is an important component of a good study design. Although it may not give assurance of a successful main study, it increases the possibility. It also reveals issues that suggest further research should be approached from a different perspective (Connelly, 2008). Emphasis has been laid on the fact that the sample size of a pilot study should be a correct representation of the target study population. The pilot study served mainly as a means to pre-test and refine the semi-structured interview protocol.

Subsequent to the pre-test, the results demanded a meticulous review, and redesign of the interview protocol (see Appendix C). For instance, I reduced the number of questions that seemed to have no direct bearing on my research questions. Furthermore, I added some prompts on questions that required me to probe further; they had previously generated monosyllabic answers. I was careful not to include the data from the pilot study in the main study to avoid misrepresentation.

Initially, I identified a female teacher from the university for my pilot study. I contacted her telephonically and she consented to participate in the study. We met in the university library on an agreed date, and the interview was conducted with her full permission for

audio and video recording. The interview took approximately fifty minutes. I began the transcription immediately, taking about five days to complete it. Being a novice researcher, I discovered that I had monopolised the conversation during the interview as the transcript revealed more of my voice than that of the participant's.

Three major factors negatively affected the first pilot study. Firstly, I discovered much later that the identified participant did not fit appropriately into the exclusion and inclusion criteria that were used as recommended by Thabane et al. (2010). Secondly, the interview was not properly conducted as I pre-empted my respondent many times, thereby generating biased responses. Thirdly, the participant and I were not relaxed as we were conscious of the environment in which the interview was conducted. We avoided raising our voices above the accepted levels, which affected our conversation flow. I sent my supervisor a copy of the transcripts, and his comments confirmed my observations of the futility of the pilot study transcripts.

I had to identify another participant for the second pilot study. I contacted another participant, this time a male student (in-service teacher), who readily consented to participate. We also met on the University premises but in a more conducive and relaxed setting. The interview lasted about forty minutes, and I immediately transcribed and sent my supervisor a copy of the transcript. I again refined the interview protocol based on the data's inadequacies. The criteria for participant selection were reviewed as well.

3.5.5.2 Face-to-face semi-structured interviews

An interview is one of qualitative research's most commonly used data collection tools. According to Silverman (2013b), it is the most natural thing to do, as they need not have a predetermined pattern but should be free-flowing and open-ended. They can be used to gather information on behaviours or experiences, opinions or beliefs, feelings, and knowledge. Interviews are appropriate where little is known about the phenomenon of the study or where detailed insights are required from individual participants (Gill et al., 2008). Interviews provide more in-depth information regarding the participants' experiences and opinions of a specific topic. Additionally, interviews provide more depth than open-ended and written questions; the interviewer is given the chance to probe the participants further (Bengtsson, 2016).

Generally, interviews are either in structured or semi-structured formats and any of the two can be used, depending on the purpose or goal. Therefore, this study engaged participants in face-to-face semi-structured interviews (Creswell, 2017). Semi-structured interviews consist of important questions that help to specify the areas to be explored but also allow the interviewer or interviewee to digress to pursue an idea or response in more detail (Gill et al., 2008). Face-to-face semi-structured interviews afforded the in-service teachers an opportunity to comprehensively describe their lived experiences in their daily encounters as they learnt with ICT as teacher-learners and taught with ICT as in-service teachers. The data captured from the interviews were used for subsequent analysis.

I developed an interview protocol for the eight participants in this study (Jacob & Furgerson, 2012) in which the first section contained questions on the background context and a brief history of the participants' lived experiences. The second section had questions on the in-service teachers' ICT skills and learning experiences; additionally, there was a section that focused on their actual usage and practices with ICT in their individual classrooms. The third section of the interview protocol focused on the experiences of the in-service teachers in light of their interaction with ICT in teaching and learning, emphasising eliciting information on their classroom pedagogy. The interview protocol was developed as a set of open-ended questions with the flexibility to alter and change the sequence of the questions based on the manner, suitability, and context in which the discussion flowed (See Appendix D).

Interviews were conducted in the school where the in-service teachers worked or on the university campus where they studied. These venues allowed the participants to remain within familiar environments. All participants were interviewed for a period between forty-five minutes and one hour at convenient places. Primarily, audio interviews were recorded with the permission of each participant, examining and interpreting the experiences, perspectives and opinions of each participant concerning learning with technology and teaching with it in their classrooms (Creswell & Poth, 2017). The interviews were pre-arranged with individual participants, usually after their classes for the day had been taught. Each participant was interviewed three times on average. However, I interviewed a few of them more than three times because I rescheduled follow-up interviews as a form of

member-checking as soon as I completed transcriptions, and I was able to identify areas that needed me to probe for further insights or explanations.

During the first phase of the interviews, the participants responded to the interview questions in the English language without the support of an interpreter. The transcripts revealed that the participants had some difficulty with English as a language to express themselves. For instance, some sentences were incomplete; the answers lacked general terms related to the teaching profession, and several had short, ambiguous answers. These responses were because the participants understood the questions but lacked the appropriate English words to express their views. These responses prompted me to engage the services of an interpreter for the third phase of the face-to-face interviews. I ensured that the interpreter possessed adequate language skills, as recommended (Kapborg & Berterö, 2002), with good command of both English and the Kinyarwanda¹¹ languages. In the interviews with the interpreter present, I observed that the participants spoke more freely and responded uninhibitedly. Their responses were longer and more meaningful when compared to the previous pilot interview sessions without an interpreter.

3.5.5.3 Classroom and learning context observation

Observation is very important to qualitative studies, as it allows a researcher to access first-hand information on the phenomenon. Kumar (2019) posits that observation is a purposeful, systematic, and selective way of watching and listening to an interaction or phenomenon as it takes place. Observation aims to have an insight into what people actually do and not necessarily what they say they do, which is the case with interviews (Silverman, 2006). Observation is a method that can be used to gather naturally occurring data about social processes (Silverman, 2013a). Observing teaching and learning activities that in-service teachers were involved in as they studied gave me ample opportunity to gain better insight into their behaviour, interaction, teaching and learning with ICT. Additionally, this helped me gain more in-depth understanding of their ICT skills, available tools, and specific practices for teaching and learning purposes. The observations for this study were in two parts: lecture room observation and classroom observation. However, it has been argued that many “teachers dislike and even fear being observed, as they find

¹¹ Kinyarwanda is the mother-tongue, and one of the official languages used in Rwanda

classroom observation stressful and intimidating” (Lasagabaster & Sierra, 2011, p.2). I attempted to reduce my presence's effect on my participants by creating adequate rapport to enable them to relax and be themselves in my presence.

I observed lecture sessions at the university, which required me to be present as a non-participant observer; to see and record the teaching and learning activities during face-to-face sessions. I was allowed to observe these lecture sessions with permission from individual lecturers in charge of the particular course units. I observed randomly selected course units to have an overall idea of what ICT experiences were like for the in-service teachers, emphasising learning. I observed eight lecture room sessions altogether. Furthermore, as a non-participant observer, I engaged in classroom context observations with the aid of an observation schedule specifically designed to gather information on in-service teachers' classroom practice. The participants invited me to observe their classrooms' teaching and learning activities whenever they planned to use ICT. I ensured that my observation visits did not disrupt their school timetable. As primary school teachers, many taught more than one subject; therefore, I observed in-service teachers' classroom teaching within the scheduled period for whichever subject they were supposed to teach with ICT as a form of data collection. The observations were usually between forty to fifty minutes, depending on the school. I decided not to rely on explicit statements from the participants concerning their experiences and practice but also to observe them as students and then as teachers in their various classrooms. The observations allowed me to tackle the issue of people not necessarily doing what they say (Pope et al., 2006).

Each participant was observed in the classroom according to the timetable schedule of the school; this came to a total of sixteen classroom observations. Some criticisms of observation as a data collection method include observer bias, the Hawthorne effect, and varied interpretations of collected data (Kumar, 2019; Macefield, 2007). I was as aware of the effect that my presence may have on the participants' behaviour and that it may distort their actions, possibly leading to an increase or decrease in certain activities or actions. Selecting a method of recording depends on the purpose of the observation (Kumar, 2019). In this study, I employed narrative recording, where I made brief notes during the observation sessions, after which I made detailed notes in narrative form after completing

each observation. The classroom observations were captured with a video recording device along with an observation schedule, with the permission of the school and participant teacher. The observation schedule allowed me to record my observation of the ICT skills of the participant and capture the various types of ICT used in a particular lesson. Similarly, I was able to record and capture images of the particular teaching and learning activities that were engaged in by both the learners and the participant teachers (See Appendix E).

3.5.5.4 Document review

Bowen (2009, p. 1), describes document reviews as a “systematic procedure for reviewing or evaluating documents, both printed and electronic material”. A document can be described as a piece of written, printed, or electronic matter that provides information, and evidence and serves as an official record. In this study, any material developed independently of the researcher that offered information relating to the investigated phenomenon was taken as a document. Document review is a way of collecting data by reviewing existing documents to gather information about the phenomena under study. It is often used in research as a means of triangulation of data (Denzin, 2012). This study used document review as a data collection method to supplement other forms of data for two reasons. Firstly, document review is an unobtrusive method and can potentially highlight issues that may have been omitted by other data collection methods (Team, 2009). Secondly, as a written form of data, it saved the researcher time and expenses of transcribing. Nonetheless, Creswell (2017) opined that document review is not without its weaknesses, including inaccuracy of documented information and incompleteness.

Documents are often created and kept for purposes different from the researcher's; however, a researcher can use them for investigation purposes. For example, as students, in-service teachers were expected to log into the university Learning Management System (LMS) through the university website to access materials or course modules for any allocated course unit per semester. In-service teachers spent an average of two weeks on campus per session. Therefore, learning through the LMS constituted a higher percentage of their study hours; Fourteen hours were dedicated to face-to-face classroom instruction, while another fourteen hours were used for online interaction through the LMS. Similarly, student-lecturer communication was maintained through this platform after the on-campus

periodic face-to-face sessions ended. I reviewed electronic documents that included records of lecturer-student chats, assignment submissions, and website updates (See Appendix F).

As a researcher, I had no influence on the development of any of the documents; this reduced participant-researcher error and was unobtrusive. In addition, I reviewed several other documents prepared or created by the participants, the school or the government, such as lesson plans, schemes of work, curriculums, and the national ICT policy document. Data from these documents were examined and interpreted to glean meaning, gain an understanding and develop empirical knowledge (Corbin & Strauss, 2008). Table 3.4 provides a tabular description of the reviewed documents.

Table 3.4

Document analysis

No	Item	Description
1	Lesson plans/Schemes of work	In-service teachers' lesson plans and schemes of work.
2	Curriculum Documents	Nine years of basic education, and Cambridge curricula.
3	Policy Documents	National ICT in education policy, university ICT policy
4	Learning Management system	Sakai LMS portal, attendance, lecturer-student communication
5	Online learning platforms	Google Classroom

3.5.5.5 Research journal

Personal reflexivity in research demands the researcher to continually question the relevance of their identity in determining how the research proceeds. Being reflexive allowed me to examine how my study is informed by my identity, location, and experience (Treharne & Riggs, 2014; Willig, 2013). The major aim of keeping a research journal is to document and reflect on my experiences as a way of thinking, understanding, and learning (Waldo & Hermanns, 2009). This is in congruence with the view of Glesne (2006), who described the role of a researcher as that of a would-be learner. Journaling has been accepted as a valid means of accessing rich qualitative data (Hayman et al., 2012), as they can be used to examine particular experiences occurring within a natural context. I kept a research journal as a method of data collection, which helped me keep records of the occurrences in the process of the research procedure. These records created a sense of

increased professional awareness that was instrumental in making informed decisions during the research process. The study used bracketing as a reflective technique (Tufford & Newman, 2012). Every stage of the investigation was carefully approached with an open mind, and personal biases, prejudices and were avoided.

Glesne (2016) stated that it is important to write short notes or memos to oneself during the research process; she stated that getting ideas written as they occur is actually the starting point for data analysis. With the research journal, I could record the experiences in the fieldwork, and the entire data-gathering adventure (See Appendix G). I recorded important dates and experiences that I perceived as a setback or encouragement on the journey. Similarly, the entries reflected the participants' conduct during the interviews and memoirs of my perceptions. These journal entries were valuable in the data analysis stage as the researcher could induce meaning from the narrative given by the participants during the interview.

Table 3.5

Data gathering techniques and instruments

PARTICIPANTS	DATA COLLECTION METHOD	RESEARCH QUESTION	DATA COLLECTION INSTRUMENTS	DOCUMENTATION
In-service teachers n= 8	Face-to-face semi-structured interviews	RQ1, RQ2	Interview protocol Audio recording device	Transcript
	Classroom Observation (teaching)	RQ2 RQ3	Observation schedule Video Recording Device	Observation protocol
	Document analysis	RQ2	Documents and Image capturing device	Field note
	Informal Conversations	RQ1, RQ3	Researcher Journal	Field note

3.6 Data analysis

After all the data has been collected, the researcher turns to the task of data analysis. Data analysis requires several closely related operations, such as establishing categories and applying these categories to raw data through coding (Kothari, 2004). Therefore, in this

section, I focus on the data analysis strategies employed in this study to decipher the large amount of qualitative data gathered. I venture into providing an in-depth elucidation of the analysis process, thereby bringing meaning, order and structure to the data (Bengtsson, 2016). The focal point for data analysis is to produce a concord between the reality of the phenomenon studied and the themes that emerged. The data collected was converted into text in agreement with the conceptual requirements of studies entrenched within the qualitative paradigm (Anfara Jr et al., 2002). Data was collected through interviews, observation, document analysis, audio, videos and still images. All data was converted to text to facilitate analysis and presentation.

3.6.1 *Content analysis*

Contents analysis has been described by Krippendorff (2013) as a research technique for making valid and replicable deductions from text to the context of their use. Different methods can be used for data analysis. However, irrespective of the method chosen, the analysis process compresses the volume of the text collected and then identifies and puts together groups and categories to make meaning of it (Bengtsson, 2016; Stemler, 2001). Therefore, this study employed content analysis (Elo et al., 2014) as a method for analysing the data gathered from the fieldwork. Qualitative content analysis is a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns (Stemler, 2015).

Content analysis is characterized by a set of techniques used to analyse textual data and elucidate themes. This includes coding, examining meaning, and a clear description of social reality through emerging themes (Vaismoradi et al., 2016). Content analysis was used to analyse the different data sets available, namely interview transcripts, videos, and still images. This method of data analysis was considered fit for this study because can analyse all the gathered data types through transcription of face-to-face semi-structured interviews, observation, document analysis, and researcher journal (Bengtsson, 2016). A conventional approach to content analysis technique was employed where data collected was structured by coding based on various themes, emerging patterns and relationships (Hsieh & Shannon, 2005). Interviews captured through audio and video recording devices, were transcribed to text by the researcher, and then analysed alongside the other available

institutional documents, such as lesson plans, syllabi, schemes of work, and ICT in education policies.

Electronic data analysis was done using software for qualitative data analysis known as ATLAS.ti version 8 (Silverman, 2013a). The Computer-Aided Qualitative Data Analysis Software (CAQDAS) assisted me in completing the task of coding, categorisation, analysis and interpretation faster. It facilitated more conceptual and theoretical thinking about the data. This particular software (Atlas.ti) was deemed fit for this task due to specific reasons, the laborious task of working through the volume of data gathered manually was avoided as it automated and sped up the coding process and provided a formal structure for storing transcripts and memos to develop the analysis (Barry, 1998). Additionally, the software was user-friendly and could perform open coding, retrieving and network building. I was required to adhere to specific procedures in preparing my data files before loading them into the Atlas.ti software (Friese, 2019). Firstly, for ethical reasons, I changed all the actual names of the participants to pseudonyms. Secondly, a document naming protocol was created to record and indicate the pseudonym of each participant and school (See Appendix H).

However, critics of automated qualitative data analysis have argued that CAQDAS causes researchers to distance themselves from data rather than being immersed in the data required by qualitative studies (Barry, 1998). Hence, I did a twofold analysis of the data, combining both the software and manual analysis methods. The manual method allowed me to read through the transcripts and work with coloured markers to highlight codes and themes.

The content analysis process began by reading through all transcripts to get a holistic idea of the data, followed by coding based on the research questions (Creswell, 2014; Krippendorff, 2013). This method of data analysis was used to make inferences by objectively and systematically identifying specified features of messages (Stemler, 2001). Content analysis allowed me to systematically work through the voluminous data collected from the participants (Smit, 2002).

- **Data coding and categorisation**

Elliott (2018) posit that data coding is a ubiquitous process in qualitative studies. It is fundamental to data analysis and is seen as how researchers break apart their data to produce new knowledge. The researcher engaged in an iterative process of data analysis whereby codes were continuously identified, and categories generated. According to Saldaña (2021), a code is a word or short phrase that symbolically assigns a salient, essence-capturing attribute to a portion of text-based data. This study employed three coding cycles to refine and highlight salient features of the collected data further and generate categories and themes to derive meaning. Although data analysis and coding have been argued to be different by some researchers (Basit, 2003; Saldaña, 2021; St. Pierre & Jackson, 2014), it is believed that both procedures are interrelated and may be carried out simultaneously.

Therefore, I embarked on the transcripts' coding process immediately after completing the first set of interviews. By employing constant comparative analysis, I started by initially reading all data to make general sense of the information collected and to take time to reflect on the overall meaning (Creswell, 2017; Creswell & Creswell, 2017). After that, I allocated codes to smaller chunks of the transcripts to indicate salient meaning or information as I read through the data again. The justification for this repetitive reading and coding, according to Saldaña (2015, p. 10), is that “qualitative inquiry demands meticulous attention to language and deep reflection on the emergent patterns and meanings of human experience”. This process was repeated for the third time, and then I could compare each new chunk of data to the existing ones to label them with the same code (Leech & Onwuegbuzie, 2007). Thereafter, all codes were grouped into categories, which aided the identification of *a priori* themes as they emerged in the process.

Two of the themes in the study were identified *priori* due to the nature of the research questions, while the others were derived *apriori*. In contrast, the other themes were developed inductively through subsequent interaction with the data. The justification for *a priori* themes is that the importance of certain issues concerning the phenomenon under investigation was so well-established that such themes were expected to reflect in the data. Additionally, *a priori* themes helped accelerate the analysis's initial coding phase.

However, I did not fail to acknowledge the weaknesses associated with it. Firstly, focusing on data that fit the a priori themes may cause a researcher to overlook data that does not relate to them. Secondly, a researcher may not recognise when an a priori theme fails to be the most constructive technique for characterising the data (University of Huddersfield, 2020).

3.6.2 Data Analysis: Classroom observation

A combination of observation protocol (Creswell & Creswell, 2017), and an image and video-capturing device were used to record the teaching and learning activities of the in-service teachers in their classrooms during observation. The video data analysis was guided by Lacković's (2018) "Inquiry Graphics" approach for coding and analysis of video data. This approach was chosen for this study because it emphasises the importance of a regenerated understanding of communication processes, especially in relation to technology mediation. It emphasises that teaching and learning are multi-modal; inclusive of body movement and gestures, print or computer screen layout, sound, photographs, 3D models, video, and any material object that mediates teaching-learning interactions. Therefore, capturing these activities in their multi-modal nature allow an opportunity to comprehend these teaching and learning interactions more meaningfully (Lacković, 2018). My focus of interest was how in-service teachers used ICT in their classroom practice, thereby capturing confidence, skills, type of tools, relevance and appropriateness of use, content, and verbal communication. Videos were watched repeatedly to identify and scrutinize the content to make new meaning from the activities engaged in during the teaching and learning process.

3.6.3 Data Analysis: Document analysis

Stemler (2001) posits that content analysis is useful for examining document trends and patterns. Documents can be analysed to verify findings or corroborate evidence from other data sources (Bowen, 2009). Pedagogical documents kept by the in-service teachers in their schools, such as daily lesson plans and weekly schemes of work, were examined. In addition, ICT policy documents for Horeb university and Rwanda were analysed to highlight insights and deduce meaning (Belsey, 2013). Through textual analysis, I could fit the analysis within the individual school context (Charmaz, (2006).

3.6.4 Data Analysis: Research journal

As a qualitative researcher, I engaged in reflective writing throughout the research process. Being a reflective researcher requires being conscious of what already structures the mental life and analysing how these underlying cognitive artefacts shape the inquiry process (Mortari, 2015). I engaged in journal writing way of reflecting on the research process in a holistic manner. The journal's content served as supplementary data and was analysed through content analysis (Elo & Kyngäs, 2008; Neuendorf & Kumar, 2015). The analysis process constituted the identification and labelling of reflective processes and searching for a common pattern among them (see Appendix I).

3.7 Issues of trustworthiness

Silverman (2013a) posits that in the conduct of research, the professional integrity of the design, collection, data analysis and publication of results should be ensured. Research is concerned with making valid and reliable knowledge ethically, and trusting research results are significant to professionals in applied fields such as teaching and learning (Merriam, 1998). When seeking trustworthiness in qualitative studies, researchers pay attention to four factors: the credibility, dependability, transferability and confirmability of the research results (Anney, 2014; Elo et al., 2014; Lincoln & Guba, 1986; Shenton, 2004). As a qualitative researcher, it is required of me to avail sufficient evidence to prove that this study pursued sound methodological rigour, and can therefore withstand any analytical defensibility of qualitative research. In the following section, I will elaborate on the factors considered in achieving trustworthiness in the study.

3.7.1 Credibility

Creswell and Miller (2000) define credibility as the extent to which different stakeholders may make the same inferences from data, and the extent to which a researcher represents reality from the viewpoint of participants, other researchers and external peers. To ensure credibility in this study, I spent about thirteen months in the field collecting data as a researcher. My decision to stay that long in the field was informed by Krefting (1991a), who posited that participants might volunteer different and more sensitive information as the report increases or deepens than they did at the beginning of the research. This period allowed me to establish the required familiarisation and trust from my participants

(Silverman, 2013b). I submerged myself in the research field to identify and verify recurrent patterns (Krefting 1991). This process is referred to as prolonged engagement (Creswell & Miller, 2000). I then transcribed the data gathered from semi-structured face-to-face interviews and classroom observations and availed it to my participants to go through and provide feedback on whether I captured their views accurately through member checking (Creswell, 2017).

3.7.2 Dependability

Data dependability refers to their consistency over time and under varying conditions (Elo et al., 2014). According to Shenton (2004), dependability is a term used in qualitative research to indicate that if work were to be repeated in the same context, using the same methodological approaches, and with the same study participants, the resulting data would be identical. As a result of detailed reporting and an audit trail of the study's processes, future researchers will be able to repeat the study, if not necessarily to achieve the same results. When the research steps are validated by examining raw data, data reduction products, and process notes, data consistency will be achieved (Golafshani, 2003).

3.7.3 Transferability

Merriam (1998) defines transferability as the extent to which the results of one study are applicable to other settings or circumstances. To enhance the transferability of this study, I provide a clear and distinct description of the research site, the selection process for study participants, a detailed account of the data collection methods, and data analysis. A researcher can increase the transferability of research findings, according to Creswell (2014), by providing extensive background information and a thorough description of the participants, the research context, and the setting.

3.7.4 Confirmability

Confirmability in qualitative studies is meant to ensure that the research findings are the result of the experiences, and ideas of study participants and not attributes or preferences of the researcher (Shenton, 2004). The triangulation strategy was employed to establish confirmability. I employed triangulation for two reasons, firstly, to confirm data and secondly, to achieve completeness. Data completeness involves bringing together several standpoints from various sources to achieve a realistic picture of the phenomenon being

portrayed (Emran, 2015). Triangulation refers to using several data collection techniques in the same study to ensure that one data collection method's weakness is compensated by using alternative data gathering techniques (Denzin, 2012). The confidence and credibility levels of a research result increase when data collected through several techniques are judged consistent (Houghton, Casey, Shaw, & Murphy, 2013). Creswell and Miller (2000) confirm that triangulation is a validity procedure that researchers use to search for convergence among multiple sources of information to derive themes or categories in the study. Triangulation helps the investigator reduce bias and cross-examine the integrity of participants' responses (Anney, 2014).

In this study, for confirmation, the researcher used and compared several data sources to determine the level to which the results could be confirmed. Four data sources were employed in the study: semi-structured interviews, classroom observation, document analysis, and a research journal. Classroom observation, for instance, was conducted to establish how in-service teachers used ICT for teaching and learning activities to compare prior and present practice after their interaction with ICT at Horeb university. This comparison was to confirm the responses given to some of the questions by the in-service teachers during the interview, in which they were required to describe the specific changes that they could identify in their practice due to the ICT experiences at Horeb university.

Method triangulation helped by collecting data from multiple sources to make up for any weakness displayed by one data collection method (Denzin, 2012). Similarly, it has been argued by Clandinin et al. (2007) that it might be difficult for a researcher to identify the story or stories that accurately describe the multiple accounts given by individuals on a particular phenomenon from their lived experiences. Therefore, to address this challenge, I allowed my participants to read through the interview transcripts to verify if the content accurately retold their stories (Birt et al., 2016; Carlson, 2010). Member checking is a recommended strategy to ensure credibility in qualitative research. I printed out the interview transcripts and invited the participants to read through them for confirmation.

3.7.5 *Audit trail*

Audit trails document the course of development of the completed analysis. To ensure overall trustworthiness of this study, the researcher meticulously developed an audit trail

by describing the steps through which the end product was achieved (Carcary, 2009). According to Cope (2014), an audit trail helps to establish the credibility of qualitative studies, and it also allows readers to prove the logic of the researcher and decide whether the findings of the study provide a reliable platform for further inquiry (Carcary, 2009). I kept a detailed record of all the decisions made throughout the research process to justify the methodological and interpretive choices made (Houghton et al., 2013). As a novice researcher, I maintained comprehensive notes with reference to the motivation, contextual setting and the rationale for methodology. An audit trail encouraged me to engage in self-questioning and reflexivity (Anney, 2014). In addition, the process of documenting this study, which includes the data collection process, data collection instruments, and data analysis is available in the relevant appendices.

3.8 My role as a researcher

My role as the primary data collection instrument demanded that I identify and acknowledge any personal biases at the beginning of the study (Creswell & Creswell, 2017). Therefore, to increase the credibility of this study, I turned to the work of Jootun et al. (2009). I engaged in research reflectivity, attempting to understand how my values and views may influence my research findings. I ensured that I approached data collection with appropriate instruments and completely disregard any predetermined ideas I had about the topic. In this investigation, I acknowledged the effect that my position may have on the context, the participants, the data collected, and the interpretation (Berger, 2015). Furthermore, I practised reflexivity reporting by informing the readers through the research journal of my actions, interests, and experiences to bracket my bias (Dodgson, 2019; Haynes, 2012). I ensured that transparency was maintained throughout the study's data collection and analysis stages (Karnieli-Miller et al., 2009).

Furthermore, I ensured the limitation of bias through bracketing, increasing the research rigour. Bracketing can greatly enrich data collection, research findings and interpretation. According to Tufford and Newman (2012), this method is used in qualitative research to “mitigate the potentially detrimental effects of preconceptions that may adulterate the research process” (Tufford & Newman, 2012, p. 1). I taught Computer Applications and Educational Technology courses in the Department of Education, which could place undue

expectations on my students regarding their practice or conduct with and around ICT. I acknowledged that my experience, knowledge and expectations could interfere with the data collection and analysis. Therefore, for the period the research lasted, I avoided teaching any courses in the department, as this could affect my participants' responses and their interactions with me.

I had adequate comprehension of what is expected of me as researcher, and I was careful to tell the study participants' story, not my own. Similarly, I understood that I played a double role in the investigation, as a researcher and learner (Glesne, 2016). Therefore, even though there were times during the fieldwork that I reflected on the occurrences, and I was unsure if anything I heard or saw would contribute anything meaningful to my study, but I progressed anyway. My progress and constant reminders about the time frame from my supervisor created some form of anxiety in me.

3.9 Ethical considerations

Any research study is carried out in a setting that has its own common values, cultures, beliefs, population, and identities. Qualitative researchers may be ethically conflicted as their research may involve some degree of personal involvement in the lives of research participants. Special attention will be given in this research to ensure ethical conduct to increase beneficial effects, and reduce harmful consequences (Silverman, 2013a).

3.9.1 *Permission to conduct the study*

The ethics application for the study was submitted to the ethics committee of the Faculty of Education, University of Pretoria, to seek approval for data collection (Guillemin & Gillam, 2004; Resnik, 2015). Upon the approval, I then approached the management team of Horeb university to request permission to conduct the study. There was a delay in securing approval from Horeb university based on institutional policies; however, the approval was eventually given. After securing the necessary certificates from both institutions, I contacted the prospective participants for my study. I spoke to some of the participants individually regarding my study's focus while I called the others on the phone. I made my intention known to a few other participants via WhatsApp. The participants that agreed to participate in the study were required to sign a letter of informed consent where all issues, such as right of withdrawal, anonymity, and data storage, were adequately

addressed. Thereafter, the participants were all willingly added to a WhatsApp group named “Adegoke Research”. This arrangement gave the researcher a faster and easier contact point. The group made it easier to pass across information and facilitated a more rapid response. The in-service teachers could also collaborate and relate within the group. Additionally, this study scientifically acknowledged and recognised all authors of the literature consulted to avoid plagiarism. The participants in this study were all categorised as adults (older than 18 years) capable of making informed decisions, and they do not belong to any vulnerable group (Lange et al., 2013).

3.9.2 *Informed consent*

Ioannidis (2013) opined that obtaining informed consent is important in any ethical study involving human beings. The study’s participants were given a clear and adequate briefing of the objectives and goals of the research. Their consent was sought through forms they were requested to fill and sign after reading through with a clear understanding of the content. The informed consent document conveyed information about the research focus, purpose, and process to the participants (Kumar, 2019). Similarly, there were informed of the risks and benefits associated with the study through the same means (see Appendix B). The participants were aware of their rights to engage in or withdraw from the study at any time. Additionally, they were assured of anonymity. All the data collected would be securely handled and used for research purposes only as outlined in the consent forms. Before the data collection process began, the Horeb University management team was approached for approval and the participants for consent. Similarly, the head teachers or the officials representing authority in the participants’ schools were also required to complete and sign consent forms to facilitate the conduct of interviews or observation within the school premises. Subsequently, the researcher and the participants negotiated a convenient time for conducting the interviews and classroom observations without interfering with the scheduled school timetables.

3.9.3 *Privacy, confidentiality and anonymity*

Securing the consent of the participants through signed consent forms alone cannot be an adequate guarantee for the conduct of an ethical study. Therefore, it is salient to ensure that the source of information collected for the study cannot be identified (Kumar, 2019).

Smythe and Murray (2000) argued that consent is a continual negotiation process. Therefore, the researcher sought further permission to use the words of the participants verbatim in the presentation of the investigation findings. The research sites and names of the participants were also kept confidential, known to the researcher and supervisor only. The responses from the participants were held securely in a computer with a secured password. In the process of data transcription and analysis, real names were replaced with pseudonyms to conceal the identity of the participants.

3.10 Limitations of the study

In any given study, a limitation allows the researcher to identify factors that may debilitate the study's findings. Intrinsic in any study, are exceptions and boundaries, which are established by acknowledging the limitations (Creswell, 2013; Simon & Goes, 2013). This study involved eight in-service teachers studying at a university in Rwanda. This sample, therefore, served as a limitation since the finding cannot be generalised to other universities. Secondly, all the in-service teachers involved in the study were primary school teachers, meaning that findings may be limited to primary school contexts alone. However, the aim of qualitative studies is not always to generalise but rather to give deep insights into the participants' study experiences. Critics of the case study approach have argued that the strategy provides little basis for scientific generalisation (Yin, 2003). Furthermore, the richness and intricacy of the collected data imply that one can derive different interpretations and probable “researcher bias” from the data collected (Smithson & Cornford, 1996).

3.11 Conclusion

In this chapter I have been able to account for the process that guided achieving the rigour that my study demands. I explained which lenses were employed for the study, both meta-theoretical and methodological. Additionally, I described the methods and instruments employed data collection, I then proceeded to justify the choice of content analysis as the method for analysing the data. I acknowledged the importance of ethical issues in my study, therefore I provided a detailed description of the steps taken to seek approval from the concerned stakeholders in the study. Finally, I touched on issues of trustworthiness as this is also vital to any qualitative study. In the next chapter, I will focus my attention on the

findings and interpretation of data. In addition, I will engage with the literature to explain my findings in the context of international debate.

4 CHAPTER FOUR FINDINGS OF THE STUDY

4.1 Introduction

The main focus of this chapter is to present and illustrate the main findings of this study. The following section presents a synthesis and presentation of the findings. In Chapter 3, I indicated that content analysis (Neuendorf & Kumar, 2015) was used to analyse all the data collected. The following section presents a synthesis and discussion of the findings that emerged from the data analysis. The findings were categorised according to the themes that emerged a priori from the main data sources, namely interviews, classroom observations, and document analysis. The lived experiences of in-service teachers and their pedagogical practices in the classroom were explored through interviews and classroom observations. I present the themes that emerged from the data using content analysis (Wodak & Fairclough, 2013) and interpretation of the findings. My primary focus was twofold, first, to describe in-service teachers' experiences as "students" in a learning context, and second to describe their classroom practice as "teachers". As indicated in Chapter 3, content analysis was used to analyse all the data collected. My field notes were also used to triangulate the analysed data.

This section presents the verbatim quotations of my participants' voices and observation evidence to underpin the themes and categories that emerged from the data. Four major themes emerged, namely, "An inevitable journey of self-reinvention", "Navigating learning in an ICT-Supported context", "Two worlds apart: the influence of school context on teachers' practice", and "Teachers as ICT agents of change", from the analysis of the narratives of the participants. The themes are further delineated into categories and sub-categories to scaffold the analysis process.

4.2 The emergent themes, categories and sub-categories

Within each theme, I elaborate on in-service teachers' learning experiences with ICT and their current classroom practices. I analysed this particular phenomenon through the lens of the Activity Theory framework (Engeström, 2001), focusing on the interactions among the elements of the model, and the likely outcomes of such interactions. The analysis began

with a focus on the motivation or rationale behind the in-service teachers' decision to engage in further learning, I proceeded to report their ICT-mediated learning experiences. I then present vignettes of the present classroom practice of the in-service teachers, highlighting the inhibiting and enabling conditions of the different school contexts in which they practice.

Table 4.1

An overview of the emergent themes and categories

Themes	Categories and sub-categories
4.2.1 An inevitable journey of self-reinvention	4.2.1.1 The need to be “ahead of the curve”
	4.2.1.2 The lack of ICT competency
4.2.2: Navigating learning in an ICT – supported context	4.2.2.1 A technology-augmented learning milieu
	4.2.2.2 Acquiring new ICT skills
	4.2.2.3 Face-to-face (contact) lecture experiences <ul style="list-style-type: none"> • Perceptions of ICT-integrated lectures • Predilection for ICT supported lectures
	4.2.2.4 Self-directed learning with ICT: Learning how to learn
	4.2.2.5 New ICT-mediated learning experiences <ul style="list-style-type: none"> • A community of practice: <ul style="list-style-type: none"> ○ Collaborating from a distance ○ Peer support through ICT
	4.2.2.6 Navigating online learning spaces <ul style="list-style-type: none"> • Abandoning the university’s learning management system • Adopting a cloud-based learning management system
4.2.3: Two Worlds Apart: The influence of school context on teachers’ practice	4.3.1 Technology exigencies <ul style="list-style-type: none"> • Lack of access to ICT • Unstable electricity supply
	4.3.2 The dilemma of school rules and policy
	4.3.3 Professional development
4.4: Teachers as ICT agents of change	4.4.1 Mirroring good ICT practice
	4.4.2 Making an ICT pedagogical shift <ul style="list-style-type: none"> 4.4.2.1 Enhanced teacher confidence through ICT self-efficacy 4.4.2.2 Transformed lesson-planning strategies 4.4.2.3 Enhanced presentation techniques 4.4.2.4 Embracing constructivist teaching approaches 4.4.2.5 Teacher Resilience

4.2.1 *An inevitable journey of self-reinvention*

In this theme, I attempt to lay a foundation for this inquiry by exploring the occurrences that preceded the decisions made by the in-service teachers in this study to embark on a journey of self-reinvention by enrolling for further studies at the university. I report on some of the antecedent factors, namely, the need to be ahead of the curve and the lack of ICT competency, which were largely responsible for the resolution made by the in-service teachers in this study to engage in the self-advancement or development endeavour. The in-service teachers acknowledged the need to acquire new knowledge and skills that would ameliorate the performance of their duties in the classroom. This would, in turn, position them to cope with the technology-related changes already unfolding in their profession and prepare them adequately for the anticipated changes in the future. Therefore, the participants embarked on a journey to reinvent themselves as professional teachers by enrolling in the university to obtain an additional degree.

4.2.1.1 The need to be ‘ahead of the curve’

The analysis of the collected data indicated that the participants in this study recognised the significance of remaining relevant in their subject field and profession. The responsibility placed on them by Rwanda’s education sector goals, government policies, and, subsequently, the curriculum to prepare learners for the 21st century workplace demanded that teachers be equipped with new and appropriate teaching skills. Therefore, carving a niche for themselves through self-advancement became a paramount need. The narratives of the in-service teachers revealed that they were aware of the necessity placed on them to remain ahead of the curve to maintain a relevant position in their careers. Rwanda as a nation, as reflected in the Education Sector Strategic Plan (ESSP) for 2018-2024, envisions a future where learners are competent to meet the requirements of the 21st century diverse labour market. The policy document indicated that adequate and proper training of teachers to apply technological knowledge and skills effectively to teaching and learning in the classroom is fundamental to achieving this desired goal.

Daudi, a twenty-seven year old male, who taught at Holiness school, explained that teachers with obsolete or inadequate ICT skills were at risk of expulsion from the workforce.

Uh-hmm, in this vision (vision 2020), in Rwanda, ICT and language are skills which are most useful. Some people will say that you are in “dot com”, so when you are in “dot com” and you do not have ICT skills, the system will kick you out. We have to be updated in ICT to prepare them (learners) for future time.

(Interview Transcript: Daudi)

Oreofe, a female teacher at Success schools emphasised on the evident change facilitated by the permeation of ICT into teaching and learning. She claimed that this is making the expectations of learners and teachers to be different from the period before the integration of technology in schools. Therefore, teachers needed to embrace technology for the challenge, and maximise the potential of ICT use in teaching and learning to be better prepared for the constantly changing education landscape.

Uh-hmm, the use of ICT is really affecting teachers, and it’s something that has come with the twenty-first century; we all need to get used to it. If we all embrace that, it can help our teaching and learning. It is helpful going through that learning and knowing.

(Interview Transcript: Oreofe)

Nyansani, a male teacher from Lower Kanazi school, explained that teachers habitually strive for excellence and are always willing to remain relevant for the sake of their learners. He made conscious efforts to ensure that his learners were prepared and possessed practical and applicable expertise needed for the future.

I need to apply more ICT skills when I am teaching my kids (learners), and I also need to keep updating myself on technological skills in order to stay fit (relevant) and feed (impart) the learners. I love learners to be equipped with ICT skills, and when they graduate, they will help their societies.

(Interview Transcript: Nyansani)

Yvette, a female teacher who taught at Lower Kanazi school, felt she lacked the fundamental skills required to deliver her lessons effectively and create appropriate and meaningful learning experiences for her learners. She realised her lack of competence and resolved to develop more skills to do better. She said she desired to improve her ability to make her lessons more impactful and engaging for her learners. She believed acquiring skills and knowledge from the university would assist her in achieving this goal.

I needed to know how to teach better. You know I was in the teaching profession, but I didn’t know how to deliver with expertise, how to teach

effectively, so I expected the university to make me a better teacher, so that I can do more in my career. The university was a good fit for me to learn more on ICT. (Interview Transcript: Yvette)

Longoria seemed to be the most experienced of all the participants in terms of years of teaching, having started teaching immediately after acquiring a diploma in Early Childhood Education. She felt she possessed fragmented knowledge that was insufficient to deliver her lessons efficiently and effectively. Improving her skills became a priority, with an expectation to perform more efficiently with increased proficiency in ICT use.

I needed to get the whole picture of the instruction set up, how it is handled, how to overcome instructional challenges. I wanted to improve on my skills, to add more knowledge, and experience. (Interview Transcript: Longoria)

When this study was conducted, all the participants were full-time teachers in various primary schools. However, being in the teaching profession with expectations to produce well-rounded learners for society, and having to remain relevant in a constantly dynamic field demanded that they have adequate techniques, approaches, and strategies suitable for teaching in 21st century classrooms. Significant among these is the need for ICT competency for enhanced and interactive teaching. This is described in the following category.

4.2.1.2 The lack of ICT competency

The “survival” of a teacher in today’s classroom without the requisite skills has become quite challenging. One such critical skill is the effective and purposeful integration of ICT into daily teaching and learning activities. Therefore, the ICT skills possessed by the participants in this study were key to their experiences with ICT, first as learners, and then as teachers. As suggested by the data analysis, the inadequacy of the ICT skills of the participants led to discouragement and almost total abandonment of ICT for learning and teaching purposes. The in-service teachers considered it a difficult and effort-defeating pursuit. Before enrolling at Horeb University, the participants’ ICT skills ranged from none to basic skills. While some could use a few computer applications, such as Microsoft Word and Microsoft PowerPoint, others found it difficult even to switch on a computer. The participants described their initial ICT competencies as insufficient, inhibiting ICT's effective use to enhance teaching and learning activities.

Yvette, a female teacher at Lower Kanazi School, described her initial ICT skills and computer experience as a novice. She expressed her frustration in a language befitting her experience of using ICT tools with insufficient skills.

*I didn't even know how to open (boot) the machine (computer), I used computers in inappropriate way, and sometimes click anywhere and make errors. It could either shut down or run to what I don't know, which scared me so much. That dampened my passion towards using ICT tools.
(Interview Transcript: Yvette)*

Oreofe, also a female who taught at Success School explained that ICT tools like computers were available in her school. Still, her inadequate skills and confidence prevented her from using them effectively. Thus, she did not incorporate ICT into instructional activities in the classroom.

I never used ICT that much except for my phone, and few things I could do on my computer. The school where I was working; they had computers. They actually gave a computer each to the teachers, but I didn't have so much skills by then. (Interview Transcript: Oreofe)

The lack of appropriate ICT skills affected the frequency of use and the purpose of using ICT for teaching. Adeline, who taught grades five and six at Upper Kanazi school, explained that in her classroom, the use of ICT was an occasional occurrence. Computers or other ICT tools were not a regular part of her teaching repertoire. She depended solely on the blackboard for her illustrations while teaching; hence she felt incapacitated and discouraged from using ICT during her lessons.

I had few skills; it was insufficient. I never used [a] computer many times. It was rare. I didn't have opportunity to practise with ICT like I did when I joined the university. (Interview Transcript: Adeline)

Longoria, a grade four teacher at Great Oaks School, also described her initial ICT skills as elementary and barely sufficient to allow her to use them for teaching and learning in her classroom. Teaching traditionally left her exhausted after each lesson. She explained that imparting her learners with knowledge and engaging them meaningfully became a herculean task to accomplish. She also described her teaching as traditional, non-engaging, and boring, with no opportunity to create exciting and interesting learning experiences for her learners. This implied that she was aware of the expected standard of practice or

potential benefits of ICT use to her learners, but she could not achieve her goals because of her ICT incompetence.

What I had was the basics. You know I knew how to type, how to use the MS Word, how to use a keyboard, parts of a computer. When it comes to technology, I was not there yet because I was so much into the ordinary part, analogue, and it was quite tiring. Getting them (learners) where you want them to be it was a bit difficult. (Interview Transcript: Longoria)

As a Grade 6 teacher of Science and Elementary Technology (SET), Nyansani narrated that before being admitted to study at Horeb University, he could not use ICT as either a learning or teaching tool to enhance the experiences of his learners as required or expected. Lack of ICT competence hindered him. Although he could type out his lesson plans and schemes of work with the computer, his expertise was quite limited in using ICT tools to infuse creativity and engagement into the learning process. He depended on a verbal explanation of concepts to his learners, engaging learners only in auditory mode, and could not engage his learners through multiple senses for learning.

My ICT skills were very limited. I had little knowledge on using MS Word and MS Excel. As a teacher, I used it to prepare exams, to fill marks. That's what I did the most with MS Word and MS Excel. I didn't possess the capacity for using ICT in teaching and learning, or to do more than I was used to doing. (Interview Transcript -Nyansani)

Limited ICT skills possessed by the in-service teachers before their enrolment to study at the university prevented many of them from exploring the potential of ICT in the classroom. While some feared the outcomes of attempting to use ICT in the classroom, others were not motivated to use it because of the lack of confidence in their abilities. Therefore, accessing ICT tools in the classroom did not result in pedagogical use for teaching and learning. Despite the presence of ICT tools in the classrooms, participant teachers still could not give their learners appropriate, interesting and engaging learning experiences. Data analysis suggested that the participants, therefore, enrolled to study at the university with expectations to improve on pedagogy and to acquire the needed skills to be positioned better in their profession. Thus, the next theme is dedicated to describing their learning experiences as students at Horeb University.

4.2.2 *Navigating learning in an ICT-supported context*

This theme is focused on exploring the learning experiences of in-service teachers as students at Horeb University. It is aimed at describing the participants' learning experiences within a learning environment enriched with access to ICT tools and facilities to provide more meaningful, engaging and interactive learning experiences. After establishing that self-development was the background context for engagement in further studies by the in-service teachers; I considered it important to explore their learning experiences as they navigated a technologically enriched learning environment at the university.

Distance learning at Horeb University was designed to train in-service teachers and was administered in a blended learning mode, as approved by the Higher Education Council (HEC). This mode of study required students to attend face-to-face lectures on campus and to participate in online learning from other different locations while away from the campus. The flexibility offered by this mode of study made it possible for many teachers to study while working. Hence, being employed as full-time teachers in different schools, the students only visited the campus at certain intervals, which usually coincided with their school vacation breaks or holidays. These teacher-students spent an average of two weeks on campus per contact session, during which they interacted with ICT tools, lecturers and colleagues. Afterwards, they returned to their respective schools to continue teaching throughout the school semester.

The data analysis revealed that during the study period on campus, students had unrestricted access to various ICT tools, ICT laboratories, and the university library for learning purposes. Learning activities included attending face-to-face lectures, creating time for self-study, and collaborating with other students to accomplish tasks assigned by the lecturers. Furthermore, learning in an ICT context allowed the students to develop much-needed ICT skills. Students relied on using ICT tools and resources to successfully initiate and complete various learning tasks that were engaged during learning, such as assignments, lecture room presentations, and the production of term papers. A significant amount of the time spent on campus was devoted to face-to-face lecture sessions that were supported by ICT for the display of visuals such as images, diagrams and procedures. Data suggests that students seemed to prefer lecture sessions supported with ICT compared with

lectures without the support or presence of ICT. During the interviews with the participants, they described their experiences with ICT during self-study while alone and in collaborative learning with peers. The category below elaborates more on their ICT learning experiences.

4.2.3 A technology-augmented learning milieu

Several participants in this study unanimously agreed that studying at Horeb University gave them unrestricted access to various ICT tools for learning. The ubiquity of ICT tools allowed for their use in the lecture rooms or in the ICT laboratories depending on the activity engaged in at any given time. The participant narratives revealed that the in-service teachers appreciated having access to computers, internet connectivity (Wi-Fi), data projectors, and smart televisions as learning tools that contributed to more enhanced and purposeful learning experiences. These technologies aided the completion of learning tasks, including assignments and personal study, all of which contributed to the fulfilment of the expectations that they had when they took the decisions to further their studies.

Longoria, whose subject area of specialisation was English and Literature, took advantage of the constantly opened ICT laboratories to research the world wide web (www), and gather further information on various subject topics.

I use the ICT laboratory as often as possible because it is always open from morning up to night so whenever I have time, I go to the ICT room, I am trying to see how to organize my work, looking at what I can see online, it helps me very much. (Interview Transcript: Longoria)

Similarly, Daudi explained that the computer laboratories at the university served as a resource centre for him, where he could use the different types of software and internet connectivity for completing assignments. He seemed excited that the university provided adequate ICT tools for students. This access to ICT seemed to spare the students from the inconvenience of seeking and paying for services that were necessary for submitting assignments. Typing, printing, and Wi-Fi connectivity could be accessed conveniently within the university study context and at no extra expense to the students.

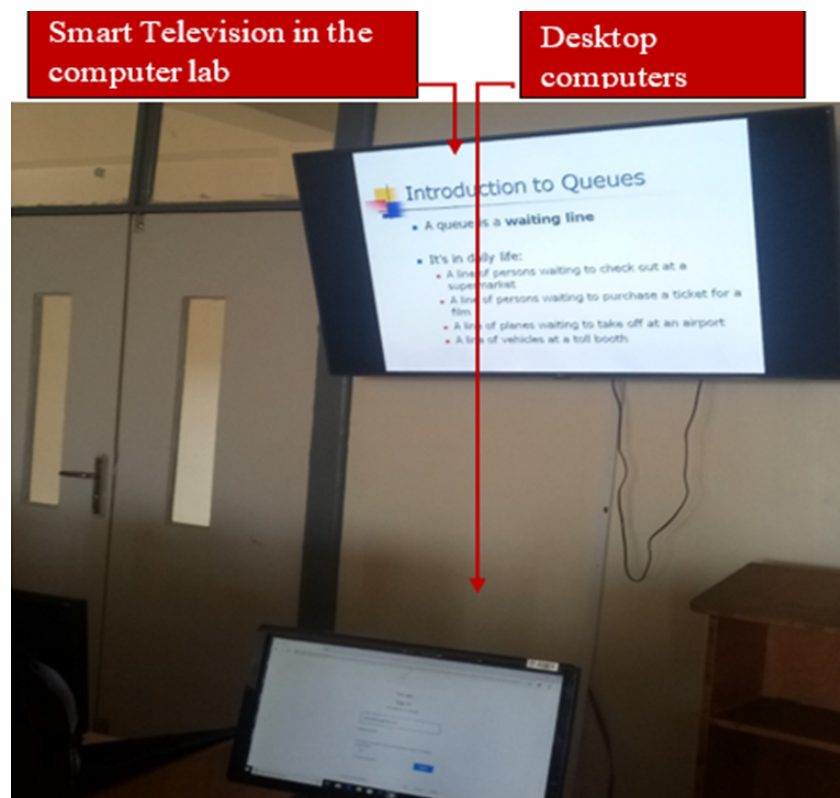
You see, Horeb has many computer labs, they have enough equipment, any floor here, there is computer laboratory where students can go, so that students can learn easily, and to get more information. There are computers with

software of course most commonly Microsoft Word and Excel. (Interview Transcript: Daudi)

The image (see Figure 4.1) depicts a computer laboratory at Horeb University. The laboratories contained internet-connected desktop computers and Smart display screens for lecture presentations and other types of learning activities in which students engaged.

Figure 4.1

One of the computer laboratories at Horeb University



Divine also seemed pleased with being able to use ICT for her learning at the university. She expressed her satisfaction with the stable and uninterrupted internet connectivity and availability of ICT tools provided by the university for students. The assurance that ICT tools were available for students' use always implied that she could rely on a technologically supportive, reliable, and conducive environment for student learning at the university.

The computers are there, they are available, we use them anytime we want, internet connectivity is also easily provided every day, we never miss internet here on campus. (Interview Transcript: Divine)

Accessing the computer room equipped with internet connectivity afforded Oreofe the opportunity to retrieve information from various sources to supplement her content while learning in the lecture room. She sometimes accessed the computer laboratory to access the library database of Horeb University, which held extensive learning resources, including past examination questions for various courses. This meant she could adequately prepare for and revise for upcoming or future examinations.

Basically, there is internet connection, so my options are broad, I can look for past questions, and do other activities related to what I am learning (like searching for e-books) I can get all sorts of information. (Interview Transcript: Oreofe)

Sylvester similarly mentioned some of the ICT tools available for learning purposes, which he used for learning while on campus. The participants all seemed to have maximised the availability of these ICT tools and resources to gather, retrieve, analyse, and organise information to construct individual knowledge in learning.

At school (Horeb University) here, I use computers, sometimes we can use projectors (Smart TVs). I also use my phone when I am at school because there is Wi-Fi in the school. (Interview Transcript: Sylvester)

Yvette corroborated Daudi's experiences. She narrated that there were sufficient ICT tools provided on campus which facilitated learning. She mentioned the availability of reliable and fast Wi-Fi connectivity enabled access to easy internet searches for relevant learning material and resources for completing assignments and other learning tasks.

There are many materials (ICT tools) that you can use when you are studying for example, when a lecturer gives you assignments, there are many computers, so you can go and do your assignments easily. There is Wi-Fi (internet connectivity) which is also very good. (Interview Transcript: Yvette)

Students' unrestricted access to, and more constant use of ICT tools for different learning purposes, as highlighted in the various accounts given by the participants, gradually impacted their skills and helped them to develop more ICT skills to enhance their learning

experiences. Some of the acquired skills, as explained by the students, are discussed in the category below.

4.2.3.1 Acquiring new ICT skills

Coping with the demands of learning in an ICT-enriched environment involved constant interaction with different ICT tools and resources for learning at the university; this left the participants in this study with no other alternative than to learn new ICT skills. Faced with a “sink or swim” situation, the participants developed several new ICT skills, which eased the challenges of learning in an ICT-supported environment. During the interviews, the participants elaborated on the self-taught new skills that they acquired in the process of learning. Most common among the acquired skills were purposeful internet research, converting documents to different file formats, downloading videos and documents, and using Microsoft PowerPoint applications, among others. They could apply these skills to their immediate learning contexts, such as typing and organising material for class presentation, downloading and saving different document types, including books for analysis, reporting, and completing various assignments. The students expatiated on these experiences through their narratives. Yvette pointed out that working with PowerPoint and mastering the application's features was a pleasant learning experience for her.

The new skills I got from here (Horeb University) are very many. For the first time, I mastered how to use MS PowerPoint, I never knew how to use it, but now I use MS PowerPoint. I have learnt how to use slide show[s] which I honestly never knew. I just found myself happily applying these skills. (Interview Transcript: Yvette)

Nyansani described how effortlessly it became for him to work with material and other documents sourced from the internet. Surfing the web became a more purposeful and directed activity rather than a time-wasting adventure. Initially, surfing the web for resources was a herculean task as he had no knowledge of which websites held the relevant information he needed for learning. He relied less on hardcopy textbooks and completed his learning tasks faster.

I discovered many websites to visit and get specific answers(resources). When I have a topic, I need to look for materials, resources and answers, to organize them, synthesize, summarise and save them. I learnt multiple ways of how to save in different formats and how to deal with those downloaded files. So, I

learnt how to do more of that, and adjusted my skills. (Interview Transcript: Nyansani)

The difference between learning “about” ICT and learning “with” ICT became apparent to Adeline as she progressed with her studies at the university. She discovered there was more to computer application packages than gathering information about what they were and their functions. She had the chance to use the hardware and applications to make a difference in her learning.

In secondary (school), we learnt about MS Word as a topic, but here (at Horeb University), we use MS Word to do assignments and during lectures. It became a tool for learning, not a topic to learn. I have also improved my projecting skills and MS PowerPoint, and I can connect the projector by myself. (Interview Transcript: Adeline)

Oreofe narrated that working with different document formats was new for her; it was not part of her previous practice as a learner. She acknowledged the tremendous difference this made to her learning activities.

Changing (documents) from MS word to PDF, coming up with different designs (for PowerPoint), making Google slides, those are the kind of things that I can do now. (Interview Transcript: Oreofe)

By engaging in different learning activities at the university, the participants were equipped with various skills needed for accomplishing daily tasks as learners, particularly ICT skills, as reflected in the narratives above. Hence, the next category further explores their learning experiences for more insight into many other ways in which ICT experiences may have impacted them as students.

4.2.3.2 Face-to-face (contact) lecture experiences

The participants in this study shared their face-to-face lecture experiences. During the time spent on campus, students were exposed to intensive face-to-face lectures, usually scheduled for three hours per lecture session. The students interacted with lecturers and ICT tools during these sessions, as it gave them an opportunity to seek clarification on ambiguous concepts and express their individual opinions on the same topics from different perspectives. Data analysis indicated that ICT tools such as laptop computers and smart televisions displayed videos and graphics such as images, models, and presentation slides

during lectures. Lecture sessions were ICT enhanced to facilitate students' achievement of a better understanding of the concepts or subject matter taught. Courses like Chemistry, Biology, Literature, Computer Applications, History and many others were augmented with videos, diagrams and pictures by displaying processes and procedures. This enabled students to grasp fundamental content in different subject areas faster and more comprehensively. Students obtained explicit mental picture of the information being passed across to them by the lecturer with less effort.

Sylvester, a student with a specialisation in History and Geography, described his experience in one of the courses named “Introduction to Computer Applications”. The use of ICT during the lecture presentation engaged the students cognitively and allowed them to be involved in learning activities. This aided faster comprehension of concepts taught, as described below.

I had a lecture of ICT (Computer Applications), we were learning about hardware devices, and the lecturer used a video to show us how you can connect all of the parts (hardware) to make it work. We watched it, and one of us was given computer hardware; she was told to join (assemble) all parts of a desktop to make it work. So we watched the video from YouTube, and she made it. (Interview Transcript: Sylvester)

Yvette, who specialised in sciences, also described her lecture room experiences. During lecture sessions in science subjects like Biology and Chemistry, watching videos and observing images supplemented with verbal explanations from the lecturers enabled her to construct knowledge based on what she had seen. She found this exciting and described her experience:

We did have some images in those projections (on the smart television). In Biology, most of the topics we did we had those graphical presentations on human systems, like respiratory, digestive, reproductive. The lecturers would show us what happens from this point to that point. When we studied topics on the Skin, too, [the]explanation was accompanied with videos for us to understand it better. It was really wonderful. (Interview Transcript: Yvette)

Similarly, Longoria, who specialised in English and Literature, described a typical lecture session in a course where a video documentary was used to explain a particular topic related to handling clients during counselling sessions. Longoria explained that the experience

provided her with detailed information on individual and group counselling. She was able to observe the facial expression, reaction, and moods, and listen to the tones of voice of both the client and the counsellor during counselling sessions as depicted by the video. This implied that she learnt from real-life scenarios of dealing with clients in counselling as facilitated by ICT.

In Guidance and Counselling, we watched a documentary about how you can treat people that you are counselling, because with some people it has to be between two people (individual), and how it can be done when you are dealing with more than two (group). Actually, it gives you a clearer picture on how to handle (real life situations). (Interview Transcript: Longoria)

According to Nyansani, projecting of subject matter through smart televisions while learning enabled him to concentrate and listen with undivided attention. He felt that being able to read the displayed content as the lecturer explained allowed him to summarise the main points from the lecture with a better understanding.

You see, the ICT (smart TV) is there on the wall. In Business Communication, he (the lecturer) brought his computer, and connected to the smart TV on the wall. Displaying what he is saying, which helps me to follow. Projection makes it simple to do summary, projecting the content while explaining. So, we see and learn, and we didn't miss any single word. (Interview Transcript: Nyansani)

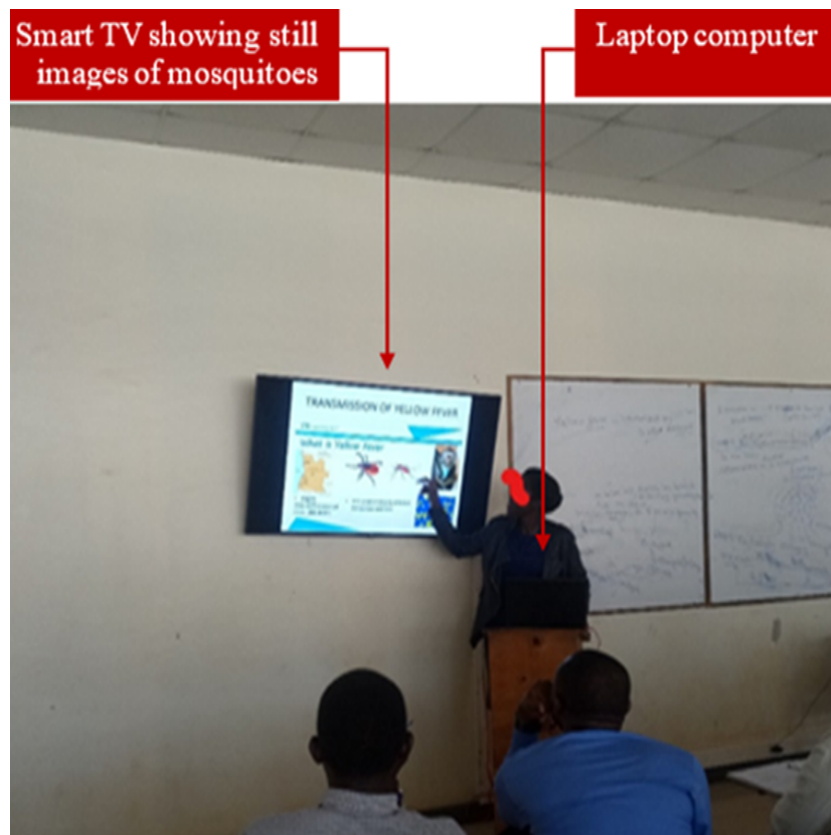
Furthermore, Yvette believed that lectures delivered with ICT facilitated interaction between students and lecturers. Students posed questions to lecturers and vice versa based on the content taught and displayed on the Smart screens. This was noticeable from my observations of a General Entomology lecture. During this lecture visit, where the topic for the session was “malaria and yellow fever”, I observed that students asked more questions when the images of mosquitos were projected onto the larger screen. This was quite different from what I observed in other lecture sessions where ICT was not used. At the beginning of the three-hour lecture, there was no projection or display of any form, and the students just listened to the verbal explanations from the lecturer. The lecture then progressed, and the images of different types of mosquitoes, showing their distinctive features, and clearly labelled, were displayed on the PowerPoint slides. At this point, students seemed to re-adjust their sitting postures to achieve a better view and were prompted to ask questions about the topic. A few students requested that the lecturer

display the previous slide. This generated further discussion and questions. The lecturer supported her explanations with the images displayed on PowerPoint slides (see Figure 4.2).

ICT makes lesson presentation effective. Students get views to question about excitedly, and are self-motivated to answer when asked. But when ICT is not incorporated in presentation, students will hardly ask or answer any question because they were either not interested or they did not get(understand) the content (concepts taught). (Interview Transcript: Yvette)

Figure 4.2

General Entomology lecture facilitated with a smart screen



Divine echoed Yvette in describing her experience with ICT-infused lectures during face-to-face lectures. She explained that ICT use seemed to depend on the course being taught. Engagement with the material and involvement in the learning process increased due to students' interaction with both ICT tools and the lecturers.

Some courses had the images. For example, in psychology, I remember the diagram that was showing us the levels of understanding. It was like a triangle that had five levels in...I think it was Bloom's Taxonomy...yeah diagrams like

that and after, they (lecturers) asked us to describe what we have seen, that is a kind of activity, and we explain what we have seen or read on the screen. (Interview Transcript: Divine)

Subsequently, I explored the participants' perception on lecture sessions that were supported by ICT. It was significant to obtain their perspective on their lecture room experiences to determine if their learning was influenced negatively or positively. This is detailed in the next sub-category.

- **Perceptions of ICT-integrated lectures**

The in-service teachers' narratives on their face-to-face lecture experiences paved the way for me to inquire more about how they perceived lecture sessions supported with ICT. The participants' narrations depicted that ICT-supported lectures appeared to be more informative because of the ICT resources used to supplement their lectures with multimedia, such as images, videos, and documentaries. Their narratives suggested that learning through ICT-mediated lectures was more permanent and concrete. They agreed that ICT-supported lectures influenced their learning differently and allowed them to use multiple learning senses, such as sight, hearing and touch, while learning in the lecture rooms.

Longoria explained that viewing what the lecturer was explaining on the projected screen afforded her some level of connection to the subject matter, thereby fitting the new knowledge into memory in a manner that would help her retrieve it easily when the need arose.

You know, when I am looking [at] the screen, the projected material, and at the same time, I am looking at your (lecturer's) facial expression, you are drawing all my attention to you. Because what you are telling me you have already put it there (projected on the screen) there is no way I can go out of that room empty, and this (knowledge) is not something that will go away because I get a clear picture (comprehend), you are making a big impact on my learning. (Interview Transcript: Longoria)

Oreofe, with subject specialisation in English and Literature, narrated that interacting with ICT during lectures enabled her to view the same issue from varied perspectives, thereby allowing her to be more engaged mentally or cognitively while learning. She felt that ICT-

supported lectures allowed her to learn from people or sources apart from her lecturers. The nature of her course of study recognised the significance of students' ability to filter and compare information from various sources. These are then synthesised and analysed for additional knowledge on different aspects of the course. For instance, in a course named “West African Literature”, she narrated how the use of ICT enhanced her critical thinking ability, and helped her see the world through the eyes of others.

I think the use of ICT broadens our horizon, it gives you a broad way of looking at life generally. You are not just cocooned into your small world. The lecturer can tell you one thing, and then you go to the internet, and you find other people that have talked about the same subject but with different ideas. It made me more open-minded when receiving information and even critical thinking wise, because you have to weigh which information is more relevant than the other. (Interview Transcript: Oreofe)

Explanation of various concepts with the support of visuals and diagrams seemed to have been more meaningful to Yvette as she voiced her opinion. The implication was that her learning was enhanced, and more value was added to the knowledge she gained from such lecture sessions. Furthermore, she felt that such lecture sessions kept her attentive and made her eager to learn. Having the points of different topics summarised and displayed during lectures kept her focused on the concepts taught.

When presentations (PowerPoint) were used to make sense of what we were learning, it was easy to learn, because you see everything in front of you. First, you are hearing and observing what is happening. From my experience when you are observing and listening to what you are studying (learning), it makes more sense. It is less boring and also keeps one's curiosity to the next chapter with the next point. So, when one is excluded and only remains listening, it (learning) is less directive. When the lecturers read or explain without projection, it made less sense. (Interview Transcript: Yvette)

Similarly, Daudi described his experience as worthwhile, he mentioned that time is more efficiently utilised, and a wider scope of topics is covered in the curriculum content. While attending ICT-supported lectures, he felt more focused, and concentration was easily achieved during such sessions because of the use of ICT.

There is a very big difference [pause] as they (lecturers) use ICT. It helps us to learn many things within the short time, to gain time, and also it helps to gain enough content. (Interview Transcript: Daudi)

Nyansani explained that he could progress through the lectures with a higher level of comprehension when ICT tools were used to teach. He found it easier to connect the lecturer's facial expression, gesture and movement with the content or message displayed on the smart TV or projector screen, thereby achieving an improved comprehension of the concept being taught in the course.

Yeah, once he (lecturer) comes using ICT, he is talking and displaying what he is saying; you see it helps me to follow. Then another day, when he comes without ICT, it is confusing because he is just talking; we cannot see or understand what he is talking. (Interview Transcript: Nyansani)

The participants' perception in this study about the significance of ICT-supported lecture sessions to their learning, influenced their decisions on which lecture sessions are more beneficial to them as students. Hence, the students became more inclined to attend lecture sessions supported by ICT. This is detailed in the next sub-category below.

- **Predilection for ICT-integrated lectures**

The participants' narratives in this study suggested that they preferred lecture sessions supported with ICT tools to non-ICT supported lecture sessions where the only supporting tools for learning were handouts or strictly verbal explanations from the lecturer. They explained that the motivation to learn in such conditions was significantly affected, and boredom was inevitable. This resulted in students skipping or avoiding some lectures completely, while others walked out in the middle of such lecture sessions. The students' narratives revealed that they preferred to attend ICT-supported lectures for improved engagement, deeper concentration, and purposeful knowledge transfer, among others. Furthermore, with the use of ICT, students could keep up with the pace of the lecturer, thereby avoiding being left behind in the learning process. Interestingly, many participants seemed to have more confidence in the authenticity of the information presented to them during lectures delivered with the support of ICT compared to sessions where ICT was not available or not used.

To me, when lecturer used ICT, the explanation was typically visible, and we students were on the same page, following and summarizing. Projecting makes it simple for me to do summary. In contrast, to he who came in without computer but just hand-out and markers, students were less motivated, and he

could wipe off information before you are done summarizing them, and then he cleans it all. Interview Transcript: Nyansani)

Being able to participate as a student, and experiencing more interactive lecture sessions helped Oreofe to learn better; she felt that teaching should be more student-centred. Therefore, she preferred attending lectures where ICT was incorporated into the delivery. She narrated that such sessions were more engaging and impactful, as the ICT helped her to be more immersed in the learning process. In addition, she explained that to be fully engaged during learning depended on how the lecturer used ICT while teaching. The projection on the smart TVs did not just capture her attention, but retained it for the duration of the lecture period.

I was more engaged with ICT; if there is a projection, you can read along the notes and follow what the lecturer is talking about. Learning is always boring so if you have to go to class and this person is just reading notes, you get bored easily. But with the projectors, it is more fun, the lesson is not monotonous, and there is some aspect of being involved, I want to be involved. It makes more sense to me. (Interview Transcript: Oreofe)

The potential of appealing to different learning styles with ICT seemed to be the primary reason Sylvester attended ICT-supported lecture sessions. He seemed to have a visual learning style which allowed him to assimilate and process information faster when it was visualised. This implies that he seemed to benefit more from lectures when ICT was used, and his attentiveness increased significantly.

The lecturer is only talking without anything (ICT) engaging the students in learning, many students don't like listening to the talking alone, but they would rather see or watch what you want to teach. When the teacher (lecturer) provides equitable knowledge by using ICT, it makes me more interested but when there is no use of ICT, I feel bored. (Interview Transcript: Sylvester)

Nyansani, Oreofe and Sylvester emphasised motivation, concentration and engagement as some of the reasons why they preferred ICT-supported classes. Daudi and Yvette seemed to associate the validity of contents or subject matter provided by lecturers during lecture sessions with the use of ICT. They believed that the adequacy and accuracy of contents depended on the ability to verify the sources of such materials. They voiced their feelings through their narrations.

...because when the lecturers come to class talking, err.... things (concepts) that do not have reference, we may not be in total agreement with the lecturer, because he may come and teach whatever he remembers, he may skip some points. It is just like going to class and thinking that you have mastered your subject, and all that you have to teach is in your head, but students may lose confidence in you, students may think that the lecturer is lying.

(Interview Transcript: Daudi)

According to Yvette, the ability to read along or observe whatever concept was being displayed by the lecturer gave her more confidence in the accuracy of the information. She believed that the visuals being displayed, either processes, models or diagrams, added more meaning to the information contained therein. As a science student, supporting any information with facts was important because science deals with facts, not assumptions or fables.

The lecturer tells you what you are seeing, and you see that what he is saying is true, because you can see it there in front of you. You are following, because you are seeing what is happening. For example, when a lecturer is showing you the Life Cycle of a human being, you are seeing clearly how it happens.

(Interview Transcript: Yvette)

She explained further that students tended to skip or avoid classes when lecture sessions were boring and non-impactful because of the absence of ICT tools to support learning. She described that students usually felt some disconnect from the lecturer and the learning process when verbal explanations were the only way to get students to learn. This usually led to students doubting the credibility of the lecturer and the source of information being passed across to them.

When a lecturer comes and projects (on the TV), it was easy to learn. You would see everything in front of you. But another day when he comes and reads only, I felt more of boredom and got the crazy idea to skip the class. You can't be bored because you are seeing everything and you are following. But if someone (a lecturer) is standing in front of you and talk and talk, you become annoyed. Even you can say that this man is lying. There was one day one lecturer came and talked, and talked, uh-hmm, many people (students) went out, because they said "is this real" "is this true?" they went away. (laughter)

(Interview Transcript: Yvette)

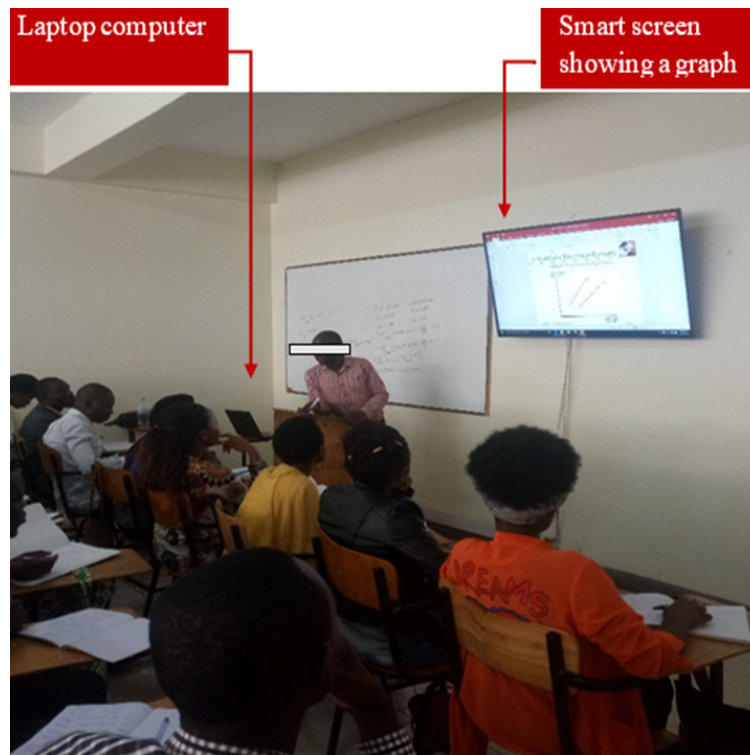
Divine also had the same experiences as Yvette's, she explained that students showed no interest or motivation to attend lectures devoid of the presence or use of ICT. Generally, the participants did not seem to get enough from the lecture sessions and would rather not

be in such classes. In the Intermediate Micro Economics lecture (Figure 4.3) which was captured from a session at Horeb University, students seemed engrossed in the lecturer's explanation.

For example, there is a time when a lecturer comes, and he is reading, but another comes, explains, and notes (writes) something on the whiteboard. Sometimes students say, "this one is reading; we can even do this(reading) for ourselves" then they just get out of the class, but when a lecturer come and explains with ICT, everyone comes to the classroom and says it is different, let us go and attend this class. (Interview Transcript: Divine)

Figure 4.3

Student in an Intermediate Microeconomics lecture



In the next category, I explored other activities that the students engaged in apart from attending lectures. This formed part of their learning experiences with ICT as students in an ICT-supported context or environment. Students engaged in self-study and peer learning activities as they navigated their learning environment. These experiences seem to have shaped their perception of the purpose of ICT tools for learning.

4.2.3.3 Self-directed Learning with ICT: Learning how to Learn

Data analysis revealed that during the time spent on campus, students dedicated some portion of their time and attention to seeking more knowledge on various courses outside the lecture rooms and independently of lecture information. Self-directed learning with different ICT tools and resources such as the internet, computers, mobile phones, iPads, and software seemed to have been quite a rewarding experience for the teacher participants in this study. Engaging in self-study allowed the participants to take on more responsibility for their learning; they selected tasks to be completed based on concepts or topics that they considered most useful to them at particular times. Significantly, the distance learning mode at the university required the participants to engage in self-directed learning to cover the required curriculum of courses adequately. The in-service teachers shared their experiences on how easy access to ICT provided them with the opportunity to engage in self-directed learning. The availability of tools and resources such as computers, internet connectivity, and mobile devices facilitated further inquiry on content or subject matter presented or introduced by lecturers. Their voices suggested that they all seemed to believe in a constructivist approach of searching for further information to achieve better comprehension of topics and content.

Most of the time, when I learn any given topic in the class (lecture room) from a lecturer, for example, when learning Linguistic, and I did not see what I learnt as enough, then I go straight to computer room, and search Linguistic background and what is related to it in order to get more information on types and many more about it. (Interview: Transcript Nyansani)

There seemed to be a general awareness and acceptance that the internet is an abundant source of learning resources, and their potential was maximised for learning. Yvette narrated that the volume of the curriculum content for different subjects differed, and she needed to supplement whatever content the lecturer gave to have a well-rounded understanding of the different topics within a course.

You see, there is so much information in Biology that you cannot rely only on what lecturers have provided. You know that, right? We go to seek for some more. I used to take a given topic the lecturer has taught or recommended, and go to the computer lab, and search for extra information which isn't on the given handout. It helped me to learn much also. (Interview Transcript: Yvette)

Longoria believed that using ICT afforded her a “my time” experience. She could explore the world just by sitting with her laptop and seeking more insight into the content that was delivered by lectures. Researching meant that she could use the lecturer’s knowledge as a scaffold to achieve in-depth comprehension of different topics. Specialising in English and Literature, she could read from different authors and widen her knowledge base through ICT. She explained:

Actually, it becomes more engaging when I am doing my own learning, I am before the laptop I can say that now that is my class; I am trying to look at what has been given to me to do, I am trying to go deeper in what the lecturer has given me. Researching different areas of the world. When they (lecturers) teach you in class, and then you go online, it means that you are going deeper to widen your knowledge on the topics. (Interview Transcript: Longoria)

Daudi explained that his interest as an Entrepreneurship student was in possessing adequate information and knowledge of what the outside world looked like regarding business and opportunities. He could not rely on the information given during the lecture presentation in the lecture rooms alone to achieve this; therefore, he engaged in self-directed learning to satisfy his thirst for more knowledge.

Sometimes a lecturer can teach a topic and give three examples. You know that’s really not enough. So, I wonder if there aren’t many more examples or information which can be interesting to know about the topic. What do I do? I take the phone and go on [the] internet to look for more. As a student of Economics and Entrepreneurship, I’m willing to become an entrepreneur, I need to know the good places where I can do my business, for example: How is capital income in Zambia? How is Uganda? How’s the economy of Zambia? How is it in Malawi? Then I compare how businesses are done in different countries, so it is the use of ICT, it is Horeb which pushed me to make such research. (Interview Transcript: Daudi)

In agreement with Yvette, Adeline explained that the conditions under which she attended classes as a distance learner were difficult because lecture sessions were scheduled consecutively throughout the day. Hence, it was not unusual to identify a few topics that required more explanation to supplement than what was discussed in the lecture. Consequently, she turned to the internet to look for more material or resources on different topics in her area of specialisation, with which she supplemented knowledge gained from face-to-face lectures. This independent study material was of immense help in revising for examinations.

I use ICT in self-study when I am searching the internet. When I have a topic I don't understand, or I want more information on, then I can Google (surf the web) and then get extra information I was looking for. Sometimes I use the computer laboratory for searching information that can help me to develop my skills by myself. Other times, I use it to search [for] information that can help me to understand well (better) the content the lecturer gave me. (Interview Transcript: Adeline)

In an attempt to access and retrieve more in-depth information on topics and concepts related to geography, Sylvester explained that he visited a website regularly dedicated to geography for personal learning. He also cited Wikipedia as one of the websites often used. This implied that ICT had improved his skills in identifying relevant online sources that could be relied on in accessing subject-specific material for personal development and learning. This option eliminated endless and frustrating web searches for useful information and made self-study more worthwhile.

I also use ICT while visiting websites. Most of us use Wikipedia, it is somehow reliable, and because I study Geography, I also use the website of NASA, they have a website which deeply explains everything related to geography and ecology. (Interview Transcript: Sylvester)

The above narrations provide evidence that the participants in this study found self-study easier and more achievable with the use of ICT. Possessing the required skills and access to the needed ICT tools encouraged them to seek knowledge and information beyond what had been presented in the lecture rooms. They could develop and sustain a habit of taking responsibility for their learning and expanding their horizon regarding knowledge consumption and use. They ceased passively consuming knowledge and engaged in deliberate and purposeful searches of relevant and beneficial information that impacted their learning meaningfully. The next category explores their learning experiences as mediated by ICT.

4.2.3.4 New ICT-mediated learning experiences

This category describes in detail the new experiences of the participants while using ICT for learning. It focuses on how ICT was used to achieve and sustain continuous lecturer-student and student-student interaction while geographically dispersed. Being distance

learners, students accessed the campus at different intervals for a short period of face-face lectures. Initially, Horeb University hosted its distance learners in a temporary facility outside the campus and did not allow for the use of ICT. Therefore, once the face-to-face sessions were completed, students returned to their various districts, and all forms of meaningful learning communication and interaction between fellow students and lecturers ceased. Thus, many students endured feelings of isolation, and temporary disconnectedness, because their learning was interrupted. However, the affordances of ICT for learning allowed the students to overcome isolation and stay connected with peers and lecturers. Communities of practice were formed within and outside the campus, and learning continued beyond the university's walls despite physical boundaries.

- **A community of practice: Collaborating at a distance**

Collaborative learning is a significant aspect of distance learning, which transcends mere sharing of information but instead entails engaging in purposeful activities that ensure learning is accomplished. Breakdown in communication after returning to their respective locations after the face-to-face lecture sessions was no longer a challenge to the students. Communication and collaboration continued through different technologies, and the participants in this study enjoyed the flexibility of determining where and when to learn. Data analysis revealed that effective cooperation between students and lecturers was achieved using technologies like email, the internet, and virtual spaces like Google Classroom and WhatsApp groups. The participants' experiences suggested that despite being geographically dispersed, they still engaged with one another constantly, jointly providing solutions to complex learning problems. In addition, communication required less effort and was almost seamless. Similarly, information related to assignments, timelines and due dates for assessment submission and feedback from lecturers were easily accessed via these channels. Oreofe shared her experience regarding this

*Yeah, it (ICT) made it pretty much easier to work together because we didn't necessarily have to be in one exact place. If we had like four questions, each one of us would do one, and then we send them all to a specific person to summarise, and we share to all of us, so then we read and send it to the lecturer. You know, someone could be in Kenya, another one at work, but we still have the same information and work towards the same goal.
(Interview Transcript: Oreofe)*

Adeline describes that participating in online spaces made it possible to exchange ideas, views and information with her classmates on different issues that concerned them as students encouraged her to collaborate with her peers. This collaboration served as an avenue to contribute to discussions, debates or arguments on various topics. These topics mostly covered academics, such as assignments, learning materials, submission deadlines, and scheduled lectures or examination announcements.

ICT helps me a lot. It gives me opportunities to work with others, to work out assignments together in a distance, like I am home and they are somewhere else, and we share our find outs via ICT devices. We usually share on different topics via Google class. That's where we can find everyone. We share academic updates, changes, challenges, etc. Everyone is always there. (Interview Transcript: Adeline)

During the face-to-face interview with Yvette, she explained that ICT helped her maintain the same tempo established in the face-to-face lecture sessions. Learning continued despite physical and geographical separation between students and lecturers. Google Classroom assisted her in remaining in contact with both lecturers and other students. It created an avenue to share, collaborate, discuss and exchange ideas on different issues.

When I am here at school (place of work), then I go the machine (laptop) then I check the classroom (Google classroom) then I see the lecturer. It is where you can do your work (assignments), I can ask a question, where you can say something (contribute to discussions) related to the lesson (topics). So, it is helpful for us to use it. (Interview Transcript: Yvette)

- **A community of practice: Peer-support through ICT**

The participants in this study reported that interacting with ICT expedited the development of learning strategies that integrated cognitive and interpersonal skills facilitated through digital technologies, thereby enhancing their experiences. The narrations revealed that learning with peers contributed to task comprehension and diligence and motivated success. The students explained that learning with others was better than learning alone, as they drew encouragement from one another. They created small learning communities while on campus and used the technologies available to them to enhance their learning. In other words, ICT allowed connecting in a community of practice because they all explored the web to improve their learning collaboratively.

We would go into the computer room as a group, and then we would search on [the] internet what we'd like to improve ideas about. We did that collaboratively. If you search [for] information to make an answer, you debate, and analyse the information. We have different sources like encyclopaedia; Wikipedia etc, and then we compare two sources of information to choose the best. We debate on that. It helps us because when we are working together, you don't get discouraged. (Interview Transcript: Daudi)

Yvette felt the same; she shared her learning experiences with fellow students as they tackled different topics and sought information to be presented during lectures. This implied that students viewed and handled learning tasks from different perspectives but with a common goal. Similarly, these meetings served as avenues or opportunities to further research various concepts that proved difficult during group interactions because of the available ICT tools.

Yeah, [pause]we used ICT in groups most of the time. We shared views on the information recapped from research. Within a team, they ask you questions, and you can explain whatever you know and if anything looks difficult, you are challenged to do more research about it with ICT, and next time you would be able to explain it better. (Interview Transcript: Yvette)

I made several visits to the computer laboratories on different occasions during this study. I observed that students gathered in groups of four or five in the labs to search for information on different topics (Figure 4.4). Discussion in such groups spanned academic and personal experiences as students, which allowed them to learn from one another.

Figure 4.4

Students in the computer lab during peer learning



Adeline belonged to one learning group where she could exchange ideas with her classmates on different concepts concerning what was discussed in the lecture room. Her ICT access enabled her to assist her colleagues with learning seemingly difficult subjects, related concepts or topics better.

*When some colleagues ask me to help with any problem or they need information from me, then I help them by using ICT, because I go and sit in the library (the library had computers too) and search information and that can help my colleague to understand well (better) what they are asking.
(Interview Transcript: Adeline)*

Students had the opportunity to learn from one another in face-to-face meetings while on campus. This encouraged sharing of knowledge and skills between them. Oreofe felt

confident to seek assistance from her classmates on difficult learning areas or concepts because of the peer-learning culture that she has developed with the use of ICT

You know most of the assignments there were group work. But for individual work, I could still call on my friend and ask them, how did you go about this, in case I am facing a challenge. I won't feel bad to ask someone else or to help someone else if they asked for my help. (Interview Transcript: Oreofe)

The participants in this study acknowledged that learning in an ICT-supported context, afforded them significant ICT experiences that shaped their learning in more ways than one.

4.2.3.5 Navigating e-learning spaces

This category describes the students' experience within two different online or virtual learning environments. To ensure that students continued learning outside the lecture rooms, Horeb University explored the potential of two different online learning platforms: Sakai, a learning management system (LMS) and Google Classroom courseware. While the former had been in existence as a learning platform for some time, the latter was adopted to address emergent learning challenges faced by the students. The sub-categories provide detailed information on the two platforms and the students' experiences using the two e-learning platforms.

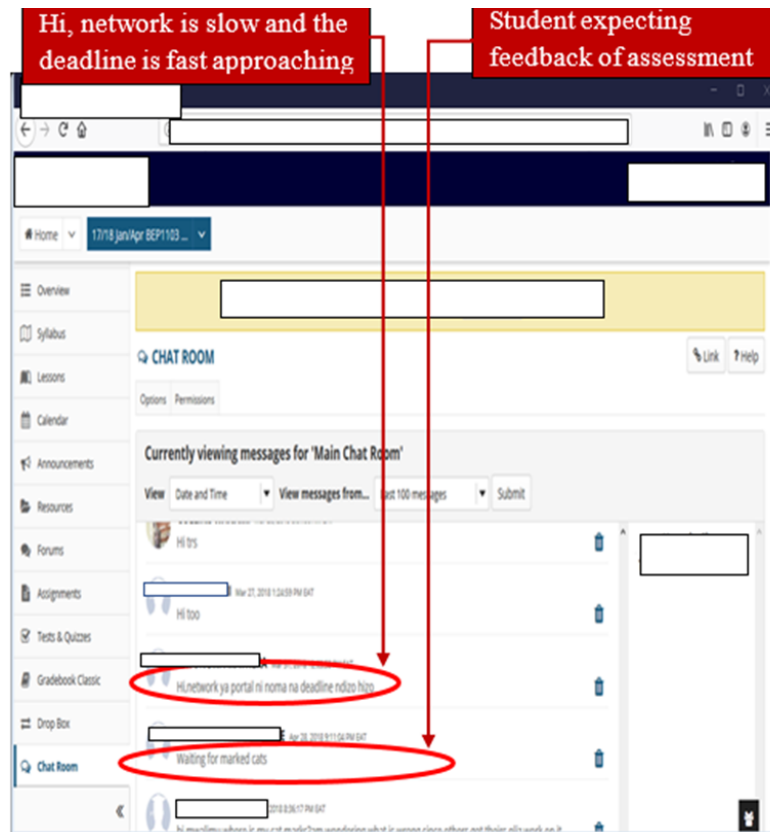
- **Abandoning the university's learning management system**

One of the learning management system platforms adopted by Horeb University at the time of this study was Sakai. Sakai is open-access software for online learning management. Designed specifically for HEIs, it supports teaching, research, and collaboration among students and lecturers. Additional features include resources, a grade book, a chat room, tests and quizzes, assignments, a calendar, an attendance register and other learning management tools. Access to the Sakai learning platform allowed students to download resources or reading material for different courses, upload and submit assignments, participate in the chat room, check their grades or feedback from lecturers, and view any announcements or updates regarding examinations or modifications to the semester calendar. For instance, the chat room on the LMS platform was where students communicated with lecturers on any related or academic issues that needed clarification. It was also an avenue for them to voice their concerns about the lack of internet connectivity

or request an extension of time for submitting assignments and address many more issues, as shown in Figure 4.5 below.

Figure 4.5

Sakai LMS Human Growth and Development



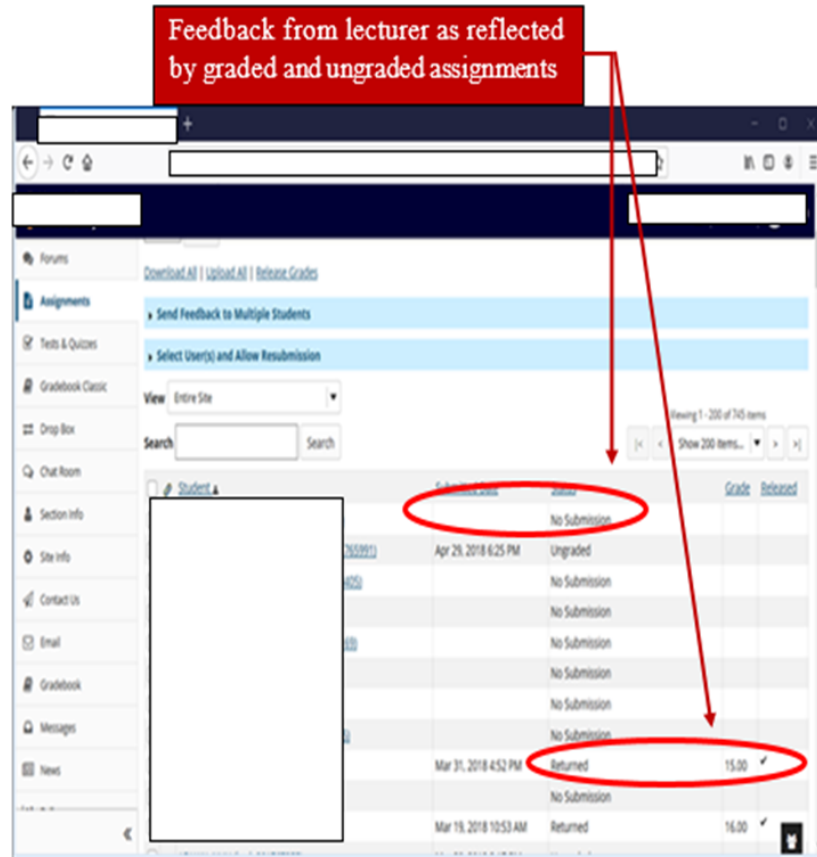
Horeb University served a diverse population of students enrolled in various study programmes through the Sakai platform. Students from other Horeb University campuses located in different East African countries such as Sudan, Uganda, and Kenya who studied exclusively online also used the platform for learning. Horeb University explored the possibility of facilitating online learning for distance learning education students through this platform to meet the requirements of the mode of learning for the participants in this study. The students were therefore required to access the Sakai LMS for fourteen mandatory online learning hours after returning to their various schools upon the completion of the fourteen hours of face-to-face contact sessions. Through the Sakai LMS,

students accessed learning material, such as modules, video recordings of lectures, and assignments. Furthermore, the students communicated with lecturers and classmates through the chatroom to remain updated with information concerning scheduled assignments and class discussions. Another online platform students accessed was the management information system platform (MIS). This was used to coordinate, control, analyse, and visualise information within the university. It served the purpose of storing and processing information regarding fee payments, course registration, teaching practice registration, graduation clearance, result slips and transcripts and can be accessed by students at any time and location.

However, data revealed that Sakai as an LMS posed certain challenges to students from Rwanda because they seemed unfamiliar with the system; hence, only a few students logged on to the system to use its tools for learning. Some of the major reasons for this, as shown in the participants' responses, ranged from lack of awareness about the purpose of the LMS portal to an inability to differentiate between the portals that they were required to log in to for different purposes as students. While some of the students could not differentiate between the Management Information Systems (MIS) Portal and the Learning Management Systems (LMS) portal, others expressed confusion regarding the functions and purpose of the Sakai platform. While the LMS was used for teaching and learning purposes, the MIS was used for administrative purposes only. The screenshot in Figure 4.6, as captured from the Sakai LMS, reflects the records of assignment submission for BEP 1104, “Human Growth and Development”. The registration numbers recorded belonged to students from other campuses who offered the same course at the time of this study. There was no evidence that students from Rwanda accessed, submitted assignments or participated in the chatroom on the platform.

Figure 4.6

Submission and grading for Human Growth and Development



When I probed the participants’ responses on how they used the Sakai platform for learning, I was met several times with confused facial expressions. There was a general lack of awareness of the LMS and its specific purpose. The few who seemed to have some knowledge of the platform's existence did not seem to have been able to maximize its potential for learning. Hence, while some participants logged in to the platform occasionally, some had not used the platform at all. Daudi, who was in his second year, was seemingly aware of the Sakai (LMS) platform, but had never used it, as reflected in his explanation:

Yes, I have heard about it (LMS) before; they told us about it at the beginning of our study they explained to us that materials are there for us to study. No, I did not use it ... The only thing we did is the way of registering (course units) in the MIS” (Management Information System). (Interview Transcript: Daudi)

The above excerpt clearly showed that Daudi could not differentiate between the LMS and the MIS. However, after further explanation of what the LMS was, he admitted he had never logged into the platform; he had relied only on books and personal search for information through the internet. Hence, he could not maximise the potential of the LMS for learning. The same confusion was evident in the response from Nyansani, as he explained that he only accessed his marks from the portal (student portal); he seemed confused about the function and purpose of the MIS as opposed to the LMS. Significantly, he also had never accessed the LMS for learning purposes as intended by the lecturers/university. Nyansani commented:

“Yes, I used it many times, when they (lecturers) update our marks we just open our portals to check. To open our portals (MIS) is easy to use”
(Interview Transcript: Nyansani).

Adeline’s response to the question about her experience with the Sakai LMS also showed that she could differentiate between the two. She also explained that she used the portal to access her results when it was released to students, which was usually at the end of each semester. She was not aware of any other portal (LMS) where she could access learning information or communicate with her lecturers. Adeline stated:

“Yes, I am aware, I use it, sometime we use it when we search information about my results, I go on that portal (MIS) when I need to see my marks”
(Interview Transcript: Adeline).

Furthermore, when I asked if she was aware the university had a LMS (Sakai) that was meant to support her studies, Longoria a second, year student, wanted more explanation on what Sakai was and how it functioned. *“Can you explain to me more about that?”* I could give a brief description of the LMS to make her understand to what I was referring. In her narration, Longoria explained that she was aware that there was a “system” that was designed for learning, but she explained that she rarely used it. She seemed to have accidentally accessed the Sakai LMS; she narrated, *“I have only been there once”*. Many participants seemed unaware of the LMS platform that was intended as an e-learning platform.

Contrary to all other students’ experiences with Sakai, Sylvester and Oreofe were the only students who used the LMS platform. They faced certain challenges that demotivated them

from further use of the platform for learning. Sylvester narrated that accessing the platform was frustratingly slow. This was usually experienced when the deadline for assignment submission was near, as many students struggled to gain access simultaneously.

We were informed about it, they told us how we can download notes, we were given a session about it, I think around April. But sometimes when there is high dependency on that website it may not work quickly so if you are demanding many things (downloading notes or uploading assignments) and there are many numbers of students who are using that site, it means it would not work as quick as before. (Interview Transcript: Sylvester)

The only student that had good experiences with the LMS was Oreofe. First, she had good knowledge of how to access the LMS. Second, she knew what was required of her to be engaged while on the platform. These experiences were evident from her account of the use of the Sakai platform for learning. Oreofe related:

Do you mean like it has a teaching forum, it has this part where people talk back and forth and there is where we have the notes, and then there is where we are informed of assignment submission? (Interview Transcript: Oreofe)

Her experience seemed to fit the desired LMS outcomes as she was able to communicate and interact effectively with students from other campuses. She expressed her satisfaction with the platform because it helped to solve the issues of anxiety or fear for students who may be unwilling to be heard or seen in face-to-face lectures. She thought that the platform could help other students who may also be intimidated by the presence of the lecturer during face-to-face lectures. She narrated:

I would say it is very educative and helpful in such a way that there are people who may not want to carry (raise) up their hands in class but there (LMS) they can easily and freely communicate. (Interview Transcript: Oreofe)

Furthermore, she mentioned peer learning as one of the benefits of using the platform and interacting with her peers. She explained that students could contribute to different topics raised for discussion, thereby facilitating knowledge and information sharing among one another. Her account implied that learning from the platform provided an opportunity to collaborate with other students. Oreofe commented:

Even if you wake up in the middle of the night you can just post the question, and even if they answer you tomorrow, but the question is out there. There is

peer learning I can ask someone else a question they can answer, and we can agree or disagree. (Interview Transcript: Oreofe)

The accounts given about the experiences with the Sakai LMS revealed that most participants did not access the learning platform as intended. This led the university to explore other platforms that could be adopted to achieve a better result.

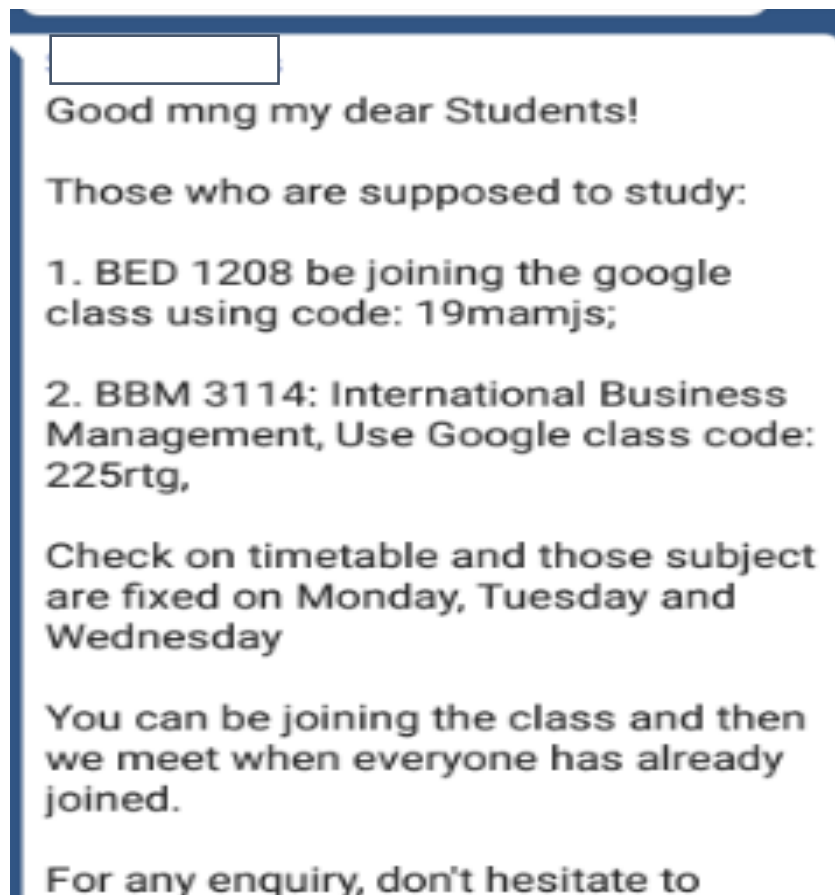
- **Adopting a cloud-based learning management system**

During the process of ensuring the validity of the data collected, I engaged in member checking, whereby I availed my participants of an opportunity to supplement my interview transcripts with any experiences that I did not capture. They shared their learning experiences with the “new” online platform they used. Horeb University decided to explore the potential of another online learning platform that could be customised only for Rwandan students to address and resolve the challenges that the in-service teachers faced with the Sakai platform. These challenges were: isolation, lack of awareness of the LMS platform, confusion about its purpose and functions, and lack of communication with their lecturers. The university took the initiative to facilitate the effective and successful completion of the mandatory fourteen hours of online learning, as required by the Higher Education Council (HEC).

Hence, Google Classroom was the online platform adopted as a substitute for Sakai. Google classroom presents a cloud-based courseware management system. The platform has different features from Sakai but serves a similar purpose. However, unlike the Sakai platform, where the bulk of the responsibility is on the LMS system administrator, Google Classroom, as an LMS, allows the administration and management of each course by the individual course lecturer. Thus, each lecturer was required to create their own “classroom”, and share the class access codes with the students to be enrolled in the particular class. These codes were made available to students through mobile social media platforms such as “WhatsApp”. As an academic staff member within the Department of Education, I, too, belonged to various student WhatsApp groups; thus, I could access some information shared between lecturers and students. Figure 4.7 depicts a screenshot from the chat groups to which I belonged.

Figure 4.7

WhatsApp social media communication about Google Classroom



Typical of any newly introduced type of ICT, students encountered challenges at the beginning but were quick to adapt to the new platform and maximise its benefits while exploiting its use for the intended learning purposes. The participants shared their experiences on the new platform with me during the interviews. Daudi recounted the many opportunities the platform provided him with, such as collaboration and interaction with fellow students and course lecturers. He enthusiastically narrated his experience below:

Google class doesn't only provide us with the way of submitting assignment and getting notes. It also provides us with collaborating way with our classmates and our lecturers. When you have challenges on your course, you use Google class to ask for help either from lectures or from your classmates. I discuss with my colleagues too; we comment and argue and share our thoughts on any issue raised. (Interview Transcript: Daudi)

The screenshot below, as captured from the Google classroom platform, confirms Daudi’s narration as it depicts some of the activities that were engaged in, which facilitated collaboration among students and lecturers alike. For instance, in a course named “Discourse Analysis”, video-recorded lectures were uploaded into Google Classroom, which generated further contributions, comments, and arguments from the students outside the classroom. Students were content to interact with one another on the platform without any feelings of isolation or neglect. Lecturers attended to student concerns or queries promptly. Figure 4.8 from Google Classroom shows the interaction between the lecturer and his students.

Figure 4.8

Google Classroom screenshot- Discourse Analysis



Adeline explained that it was initially challenging to use the platform; however, Google Classroom’s user-friendly interface made the transition simple. Access to individual

lecturers seemed much easier on Google Classroom than on Sakai, as each class was created and administered by the lecturer assigned to teach the particular course. This allowed the students to interact more constantly with lecturers as their academic concerns were addressed with the required dedication and attention.

Google class helps me because I know what I need to do on time. When I have an assignment or when I have a work to do, I can send it on Google class. I also chat with my lecturers, when I have anything that I need to share with them or want to ask. I also get notes on Google class. I can also discuss with my classmates so that we can share ideas. (Interview Transcript: Adeline)

The rationale for adopting Google Classroom by Horeb University was two-fold, firstly, to allow students to cover the mandatory online hours of learning, and secondly, to allow maximum use of the time allocated for face-to-face lectures. This purpose seemed to have been achieved, as revealed by the data, as students said they were no longer required to submit assignments before leaving the campus. Figure 4.9 shows a screenshot of a lecturer of Literary Techniques sending a reminder to the students about the deadline for the assignment submission. Previously, students were required to hand in their assignments before departing the campus; this affected the contact time that was supposed to be spent in the lecture rooms. Students were usually stressed about meeting several deadlines for submitting assignments. Thus, they missed lectures to visit the ICT laboratories to meet the deadlines for submitting assignments. However, with the adoption of Google Classroom, students could now attend face-to-face sessions more regularly, with the assurance that assignments could be submitted online and at a more convenient date and time.

The participants' various experiences attested that meaningful learning took place on the platform after they left the campus and at the end of the face-to-face sessions. Yvette's account revealed that Google Classroom created more time for learning and interaction among students and lecturers. She narrated excitedly how collaboration and sharing of both material and views among lecturers and students were effortlessly achieved. She was particularly excited at the newly gained knowledge about the platform's potential. Yvette explained that although the Google Classroom application had been on her device (Chrome Book) for some time, she had no idea about its functions or purpose and, therefore, never

used it. However, the transition to Google Classroom by Horeb University ignited both Yvette and Adeline’s interest in the significant advantages of the platform. She describes below:

(Exclaims) Haaa! I used it, that is even my experience, yeah that is my experience here (Horeb), the first one is Google Class, it was my first time. We have it in my Chrome but I did know how to use it. If you get a problem, then you write, then other colleagues can reply you, they answer you. It was very hard before to work on the assignments, but by using the Google classroom, whenever we are at work or at home, we can do our assignment, and send it to the lecturer. Instead of taking a long time on assignments, so the time for learning has increased. (Interview Transcript: Yvette)

Yes, it helped me to interact with colleagues to ask the questions, even with my lecturers it is the same. The lecturer can say “please this is your assignment I need you to submit this day”, so everyone is seeing that information, so you start to go and search and do that assignment. (Interview Transcript Adeline)

Figure 4.9

Reminder on assignment for Literary Techniques



The efficient and effective use of e-learning ICT tools for teaching and learning became a new focus for students. I gave attention to the third theme that emerged from this study's data analysis, which focused on examining the evident contrast between the university context where the in-service teachers studied and the school context where they practiced.

4.3 Two Worlds Apart: The influence of the school context on teachers' practice

This theme highlights the stark contrast between the experiences of the in-service teachers at Horeb University and the very different experiences in the schools where the teachers taught. Horeb University supported the in-service teachers (as students) with the required ICT tools and infrastructure, such as ICT laboratories, computers, internet connectivity, projectors and Smart TVs. At the schools, the scenarios were different. First, the schools where the in-service teachers worked could not be well-equipped with ICT. In this regard, I discuss how the school context significantly influenced the practice of the in-service teachers in this study.

4.3.1 *Technology exigencies*

Data revealed that despite the evident acquisition of participants' ICT skills and their transformation in classroom pedagogy, the school context influenced their classroom practice. The different contextual scenarios that inhibited the daily teaching and learning activities of the in-service teachers' practices included lack of access to appropriate technology, erratic electricity supply, non-existent policies to guide the integration of ICT in the classroom, inadequate ICT infrastructure, and constraining rules and regulations guiding the use of ICT tools.

- **Lack of access to ICT**

Through the accounts of the participants in this study, it was established that the lack of access to ICT tools in the schools impacted their practice. Many participant teachers expressed their frustrations about coping with the school situation's constraints. They explained how this lack of ICT negatively impacted their teaching practice and despaired. Sylvester expressed his excitement at the possibility of having a fully equipped "Smart Classroom" or a classroom that "talks". He believed classrooms should be equipped with ICT tools that would not need to be shared among the student or teacher population.

Yeah, they (ICT tools) are available but not to the highest level, but the basic ones are there. Yeah [pause]. I wish I had uh-hmm, a Smart Class, full of everything (ICT tools) which is not going to be taken out, which is always there...which is static and every time I want it, I go there and find it. (Interview Transcript: Sylvester)

Adeline described how frustrating and disappointing the occasions were when she prepared to teach with ICT but could not because of computers' unavailability. This situation frustrated them as teachers and dampened their learners' morale. She narrated how difficult it was for learners to cluster around the few available computers because the learners always outnumbered the available computers. Hence getting learners to complete individual tasks during the lesson became arduous. She narrated thus:

When I need to use it (ICT) in the class, or when I need a machine (computer) to give the students to do research, it is difficult. For example, when I teach, I use the machine like twenty (units of computer) and I have sixty students. It is a problem because four students are on (share)one laptop. Also, when I need to use ICT and other teachers have it then I teach without using it. That is a problem. (Interview Transcript: Adeline)

Although the government's aim is for the learners to have access to ICT tools, this is far from the reality, and lack of access to basic ICT tools being experienced in many schools has made this almost impossible. Naturally, teachers cannot adequately plan learning activities that involve the use of ICT, thereby reducing the interest and the frequency of the use of ICT in the classroom.

The way I see it right now they are not sufficient because there are still some classes with high population which means it is still impossible for each child to get one laptop of his or her own during the class. So, they share laptop, which I call insufficient because the moment you are teaching, every learner should have tools equals to their numbers. So, when resources are less than learners' numbers it's not sufficient. (Interview Transcript: Daudi)

In significant contrast to the other schools, Peace Academy seemed to have sufficient technology as all the classrooms were equipped with multimedia projectors. Students had access to individual iPads kept in the classroom at all times for easy access when needed. Divine narrated that the assurance of being able to access these tools whenever required enhanced her confidence in the successful delivery of her lessons.

*You know entering my classroom, and seeing how it is very smart (equipped with ICT), everything (ICT) is there, you know, I can use a computer in the classroom, every teacher has his/her own computer, every class has a projector. We have the Tablets to help the students.
(Interview Transcript: Divine)*

However, despite the general inadequacy of ICT tools in the schools, there seemed to be future planning as nuanced by some of the participants' narrations. School management suggested plans for increasing the number of ICT tools in the schools, such as projectors, computers, and iPads in the near future. In addition, it seemed that the funding sources for the different schools impacted the type of tools and their availability. Data analysis suggested that the schools that were privately owned and funded either by individuals or foreign organisations were better equipped with ICT tools.

- **Unstable electricity supply**

Unstable electricity supplies hindered the study's participants from using ICT regularly in practice. Participant narratives suggested that plans to use ICT during lessons were sometimes thwarted by the unreliable power supply, without which ICT use becomes futile in the classroom. The participants used the ICT in their classrooms to project videos, show documentaries, browse the internet, play educational games and listen to audio. Hence the unavailability of power significantly affects these ICT activities. Data analysis suggested that whenever there was a power outage, the in-service teachers were forced to return to their traditional methods of teaching, where there was a heavy reliance on "chalk and talk" for subject delivery, with minimal visualisation from charts or drawings. Yvette explained that considering the age of her learners, she usually had to prepare paper-based drawings and hold them ready as a backup plan in the event of a power outage. She said that teaching them without visual aids, electronic or otherwise, would be chaotic and less impactful.

*Uh-hmm. [laughs loudly] You know, when the power goes off, everything stops and the kids become annoyed (unhappy). Such young kids want a class with something they see and touch so when the electricity cut-off it's so sad.
(Interview Transcript: Yvette)*

Adeline corroborates Yvette's experiences, as she also had to use alternative methods and materials for teaching without electricity. She often planned to project the lesson plan,

which included images or diagrams, and have her learners do individual activities after the lesson. Still, the power outage sometimes hindered her plans. Hence, she had to adapt her teaching methods to these unexpected situations, such as employing group work instead of individual activity, as this would allow learners to share the few computers powered with batteries. Adeline explained:

For example, in the morning, I have prepared my lesson with laptop (soft copy), and every learner is supposed to have a laptop. Then I come to school, and power is off. Then we try to search other materials to use in the lesson; then we use five or six computers because the power is off, and the connection (internet connectivity) is not there. If I have three or four computers, then I use group work. (Interview Transcript: Adeline)

Yvette added:

“Yes, materials are there except when you have the problem of electricity because materials work with other support for example like electricity” (Interview Transcript: Yvette).

Sudden power failure during the lesson caused a loss of concentration for the learners, leaving the in-service teachers struggling to recapture their learners' attention. Similarly, learners were frustrated with the unpredictable availability of power, which affected their enthusiasm levels for participating in classroom activities.

4.3.2 The Dilemma of school rules and policies

This category describes the situation in the participating schools regarding the existing rules that guide the use of ICT for teaching and learning in the classroom. The activities of the in-service teachers were also influenced by the constraining rules instituted by their schools to guide the use of technology learning tools and resources. While there were often no clear written guidelines or policies on the use of ICT in the classroom in many of the school research sites, others do have some form of verbal communication which mandates how teachers use ICT. Hence, many in-service teachers seemed to face a dilemma of pursuing personal initiatives and constraining schools' rules governing ICT access and use.

While some schools had informal rules communicated through emails sent to staff, other schools had neither written nor verbal rules. In this case, the in-service teachers were left to use their own discretion on the aim of ICT use in the classrooms. An exception was the use of ICT in preparing examinations and recording the student grade report. These actions

were accomplished by using different administrative software the schools had adopted for this particular purpose. Nyansani explained that his school at Lower Kanazi had no specific rules in place to guide the use of ICT in the classroom.

No, there are no rules or regulation, teachers use it (ICT) when they need or want, it is not compulsory, but during the report, every teacher should make a (grade) report in soft copy. (Interview Transcript: Nyansani)

Similarly, there were no documented rules or regulations to streamline the use of ICT for teaching and learning at Great Oaks school; teachers used ICT at their own discretion. Even though the school management insisted on using ICT, there were no documented guidelines to enforce and manage its use. Longoria, who also performed the duties of the administrative head in her school, stated that teachers “know” that they should use ICT.

“Yes, it is compulsory, totally compulsory, because for report, test, project and other things it is compulsory” (Interview Transcript: Longoria).

However, when I probed further to confirm if there were rules to guide the use and integration in practice, she explained that such rules were not documented; they were only communicated to the staff verbally.

“No, we don’t have such documents in place, but every teacher is supposed to use it, it is compulsory for them to use it (ICT)” (Interview Transcript: Longoria)

Also, only verbal communications sensitised teachers about the use and importance of ICT in their practice at Lower Kanazi school. Hence, teachers employed the available tools based on personal decisions and interests. Yvette confirmed that the Director of Studies (DOS) communicated verbally, and there were no established channels to ensure that ICT was being used in the classroom; hence consistency of use was at the sole discretion of the teacher.

No, not exactly, but we must use ICT because they (school management) bought Wi-Fi (internet connectivity). So, I think if you don’t use ICT in your teaching, your Chrome Book is useless which is not really the prime purpose to bring of all of those (ICT tools) in our school. DOS (Director of Studies) said you must use it. (Interview Transcript: Yvette)

Significantly, the scenario was different at Success school, where the rules and regulations existed in documented formats and were additionally communicated to staff members. In addition, a mechanism was devised to monitor the compliance level of the teachers on

adhering to the rules and regulations. This differs from that operated in other schools participating in the research.

There is this policy saying we should use tablets, and computers for the students, make plans for it every week. It is documented. The principal sent an e-mail about that. There is a book in the office for tablets, and for computers that the principal constantly checks if everyone is signing for them to check how many times you signed for them in a week. (Interview Transcript: Oreofe)

Even though teachers have come to accept that they cannot avoid using ICT for teaching and learning, without establishing comprehensive policies or regulations to guide them in practice, achieving these goals may be far from becoming a reality. A lack of unifying school-level ICT policies would only result in haphazard forms, levels and purposes for teaching and learning.

4.3.3 Professional development

Some schools where in-service teachers were employed had various mechanisms in place to support the practice of the in-service teachers, which included professional development, provision of ICT tools and facilitating easy access to the tools for teaching and learning. The participants' narrations on professional development revealed that they participated in training dedicated to sustaining their transformation in their practice; however, experiences differed from one school to the next. While some schools organised training consistently at certain times of the year, other schools organised training according to the availability of resources and personnel. For instance, Yvette and Nyansani, who both taught at Lower Kanazi school, narrated that professional development training was conducted by experts.

Yes, you see, we have been trained like, uh-hmm, two months about using XO laptop or OLPC. Its someone who came from Kigali, the owners of the school they bring him here, so I don't know, I don't remember his name. (Interview Transcript: Nyansani)

Every summer, they give us training; someone called Sherry is the one who trained us on how to use ICT she is our head teacher in the US she is white (laughs). They train us for two weeks every summer. Those machines (Chrome Laptops), how to use projectors, and even how we can teach them (learners) by using whiteboards, those ones (points at the boards). (Interview Transcript: Yvette)

Adeline participated in professional development training that helped sustain her science teacher skills through collaboration between Upper Kanazi school and the Rwanda Education Board. Her narration revealed that the training was not provided consistently; she had only attended training once before, compared to other schools like Lower Kanazi, where training was given annually.

We had training about ICT from REB (Rwanda Education Board). It was for one week. We trained on how to use MS Word, MS Excel, how to search information needed with ICT, many activities we need to do with computer. We were taught how to use network connection, how to integrate ICT in the lessons, for example when we teach mathematics or science. (Interview Transcript: Adeline)

Great Oaks school provided professional development training to its teachers through affiliation with external organisations. Teachers could access online training programmes every semester to keep improving their required ICT skills and pedagogy in the classroom. Oreofe found this opportunity quite helpful as it helped her and her peers learn from the knowledge of teachers from other countries.

For Cambridge schools, they have a British Cambridge website, and every teacher who works in a Cambridge school has a password and an account where you're supposed to have online trainings, and I've had one where they were teaching the use of ICT in class. (Interview Transcript: Oreofe)

The in-service teachers in this study benefited from professional development offered by the schools, which contributed positively toward the sustenance and improvement of pedagogical changes. This occurrence differed from the previous scenarios where teachers' practices were devoid of any form of professional development. Additionally, there seemed to be a new trend where schools provided training on the use of ICT to newly employed teachers, as ICT skills were regarded as significant to their practice.

4.4 Teachers as ICT agents of change

This theme describes the transition made by the in-service teachers from using ICT to acquire knowledge and skills in university to utilising the acquired ICT knowledge and skills in their practice, which is central to this study. The study's findings suggest that teachers' mindset and professional preparedness to enhance their pedagogical transformation enhanced by ICT are changing, albeit slowly. Evidence of linking theory to

practice, in other words, pedagogical changes in the practice of the in-service teachers in this study revealed new ways that teachers planned, organised, and executed teaching and learning activities in the classroom using ICT.

First, in contrast to in-service teachers' previous practices, which were almost devoid of the use of ICT in the classrooms, data analysis revealed that classroom activities of various types were purposefully accomplished through the use of ICT. Furthermore, exploring the advantages and affordances of ICT in achieving transformed practice became central to accomplishing daily teaching tasks (Vandeyar, 2020a). Secondly, with the efficient and appropriate use of ICT, teaching became a more purposeful, effective, and interactive activity for the participants as new teaching methods emerged with the use of ICT. Lastly, in-service teachers developed new initiatives to overcome the persistent systemic challenges faced in integrating ICT in the classroom and preparing their learners for the 21st century workplace.

4.4.1 *Mirroring good ICT practice*

The ICT learning experiences of the in-service teachers at Horeb University consisted of their interaction with technology and their observation of their lecturers' use of ICT. For teaching, the lecturers employed several types of ICT tools, devices and resources such as PowerPoint presentations with multimedia, projectors, YouTube videos, and documentaries. These presentations facilitated and improved learner engagement, improving effectiveness and concrete or visualised learning for the in-service teachers. The outcome of the use of ICT in teaching and learning by the lecturers, added value to the learning experiences of the in-service teachers. Thus, students' deeper understanding of the significance of ICT in the learning process was entrenched.

The continuous interaction between behavioural, cognitive and environmental influences seemed to have prompted a change in the perspective of the in-service teachers about the concept of learning with ICT. The participant teachers also seemed to develop a more distinct understanding of the expectations placed on them as teachers to create authentic learning "experiences" in their classrooms. This understanding was evidenced in the participant narratives during the face-to-face interviews and classroom observations. The

participants expressed their opinions on the significance of creating a learning experience for their learners in the same way their tutors did.

Sylvester explained that the observed methods of integrating ICT into teaching by lecturers, such as videos to visualise abstract concepts, enhanced his learning, and he felt a sense of responsibility to recreate the same with his learners. Reproducing their lecturers' teaching method with regard to ICT required the use of cognitive skills with which to select the appropriate material and resources for teaching and learning in their classroom.

If a lecturer is teaching us 'Volcanicity', it is hard to see it (a volcano) while you are in Kigali or in Eastern Province, but when you watch it (a video), you can say 'if I ever come across a mountain which looks this way, I would identify this is a volcano. So, it makes sense, it provides me with enough knowledge to understand it, and when I teach a topic which includes a volcano, I use the same method the lecturer used, so you see it is shaping the way I teach. (Interview Transcript: Sylvester)

The in-service teachers as direct beneficiaries of the integration of ICT in teaching and learning made conscious efforts to enable their learners to enjoy the same experiences. The participants in this study were determined to create more meaningful and interactive learning experiences for the learners in their classrooms. The effectiveness of the ICT used by lecturers to facilitate learning created a lasting impression on them as in-service teachers. Similarly, the lecturers' ease and consistency of use was a source of motivation for them. Oreofe explained it thus:

I want to do what the lecturers are doing and even do better. When the lecturers are using ICT, it is a good example for us, and we feel we also have to do the same; we see the importance, we see how easy it is, we see how convenient it is, and so it makes us do the same. (Interview Transcript: Oreofe)

Similarly, Daudi and Adeline excitedly recounted that observing the lecturers use ICT at the university motivated them to repeat the same process with the learners in their classrooms, having experienced the outcomes of the interaction with ICT themselves. These comments imply that the interest and attraction to use ICT in their own classroom originated from and increased with their experiences as students at the university.

Yes! Actually, uh-hmm, let me give you an example, what I do now in my class, the way lecturers behave, students copy them. So, as a lecturer comes and uses

*ICT in the class it influences us, we copy them as they do, and we go and make implementation of the same, helping our learners in the school.
(Interview Transcript: Daudi)*

Adeline was quite enthusiastic about recreating the same experiences that she had with ICT with her learners, as she seized every teaching opportunity to use ICT in her classroom. She displayed her skills, which I considered quite impressive during my visits to her classroom for observation.

The way I see lecturers when they come into the lecture rooms using ICT tools while presenting and teaching, I come to apply it in my school. They sometimes guide us too on how to apply or integrate ICT in our teaching in the same way they do. I imitate my lecturer and then I come and put it to practice in my school, I apply the same methodology and techniques.

(Interview Transcript: Adeline)

Visualisation of various concepts through ICT made it easier for the in-service teachers to keep track of and understand better the information passed by the lecturer while learning. It also reduced the efforts made by the lecturers to ensure that learning took place. This visualisation served as a motivating factor to Nyansani, as he adopted the strategy to similarly reduce the amount of energy he used in explaining concepts in his class while teaching.

Yeah, it is good projecting on the smart TV; that is one thing I picked, it reduces the talking for the teacher, that reason pushes me to use ICT in my class. The way they (lecturers) use it (ICT) motivates me to use it in my own class as well

(Interview Transcript: Nyansani)

Lecturers at Horeb University demonstrated the use of ICT for teaching by constantly displaying learning materials that aided further comprehension of curriculum content. Divine explained that she found this helpful as a student; hence she was motivated to put in more effort to ensure that she employed ICT for teaching in her classroom.

You see, when they (lecturers) are using ICT in the lecture rooms, it is like to give us the examples, good example to teach. Sometimes I feel lazy to use a projector, but because our lecturers are using it many times, me too I see the way it helps me in my classroom, I see that it helps my own learners where I teach, I have got a good example from them. Interview Transcript: Divine)

The positive learning experiences of the in-service teachers with ICT as students at the university yielded significant pedagogic results in transforming practice in their classrooms. Some of these changes, as evidenced by data analysis, are discussed in the following sub-categories.

4.4.2 *Making an ICT pedagogical shift*

The requisite changes in the pedagogical approaches of 21st century teachers are in response to the increasing presence of ICT in the classroom. Hence, teaching may be transformed into a more purposeful and engaging activity facilitated by the interaction between the teacher's pedagogical and technological knowledge.

Sylvester explained that there was a change in his practice as indicated by the teaching strategies he now employed in delivering the curriculum content. There now exists a significant shift to a constructivist teaching approach, in which teaching becomes more learner-centred, a trend disparate from the traditional teaching practice that defines most Rwandan classrooms. Since different topics required different teaching methods, Daudi explained that he now relied on ICT to search for teaching methods that could be adapted to fit his classroom context, which would allow him to progress systematically through teaching. The teaching process, from preparation to delivery and evaluation, is carried out with the learners constantly in focus.

*When you are talking about pedagogy, you talk more about teaching methods, what we teach and the way of teaching them. Let us start from what we teach; as teachers, we have to prepare subject contents which is appropriate, complete (accurate), and enough (sufficient) for the learners. As we use ICT, it helps us to prepare appropriate, and complete content. Then methods, many times, you may even not know how you can teach a certain lesson for example, but when you go and search the internet, you are advised on how to teach the lesson without frustrating the learners, starting from simple to complex.
(Interview Transcript: Daudi)*

Sylvester's account depicts that his learners now take full responsibility for learning with ICT, and teachers are present in the classrooms as the "guide on the side" to help learners discover knowledge. He emphasised that such practices rarely occurred in his classroom before. Learners now make a concerted effort to seek knowledge in contrast to what transpired previously.

So, this time the students are working hard to find out everything they want to know and to use ICT to know it by their own. That means they don't need me to guide them, which is far away from what has been happening before in Rwanda. (Interview Transcript: Sylvester)

Yvette explained that learning with ICT influenced her teaching methods, acknowledging that ICT skills evolve daily, and so should teaching methods. She decided to learn through the internet from the experiences of teachers worldwide who had taught her level of learners before. This way she would employ the same proven teaching methods that worked for them. ICT helped her to effectively and easily combine different teaching methods that fostered learners' engagement through all their senses. Additionally, she used YouTube videos to improve her expertise in pedagogy and teaching approaches. She commented:

Yes, I search (the www) how others are teaching, so I download (videos of) how others (teachers) have taught for example in the US, and I study how others have taught, and then I come and I teach my kids. It is a change, the first one is the method, the method that I used in 2015, I used to write on the board only, but now the method has been changed to listening, writing, and seeing, those are the three that go together at the same time. Also, I was unable to vary teaching techniques for my learners; giving them age-appropriate content but all of these areas of improvement I needed are now fixed. (Interview Transcript: Yvette)

Longoria and Adeline seemed to concur with Yvette as they described the impact of ICT on their teaching approaches. Both participants believed that a significant difference existed between previous traditional practices in their classrooms and the present changed teaching methods. Longoria suggested a demonstration method accompanied by more emphasis on projected videos helped her to involve her learners actively in the lesson. They implied that the new teaching approach facilitated the learners' involvement in their class more than before.

You know ICT is bringing a better touch in the methods and approaches of teaching, ok, uh-hmm, I have an approach of demonstration, most of the things (concepts) I am going to be teaching I am going to demonstrate. If I am talking about walking, touching, seeing, am showing them that now I am walking, now I am touching, then the ICT comes in, and you put it there (display) for them to see 'now Evelyn is walking, he is now running'. I am using different approaches, they see me, then they see somebody on the screen (ICT). I show

them animals doing the same. I can show them that animals have four paws, but one of the paws it uses it to touch, they see them as legs, but you can see the dog doing this (touching), can you do the same?
(Interview Transcript: Longoria)

Adeline also added that her ICT experiences at Horeb University were a catalyst to make her a change agent.

I wasn't using ICT before joining Horeb University, but ever since I went through many classes (learning activities) where ICT was integrated, and I fully experienced how it boost (increased) the rate of content delivery, and how it enlivens learning process when it is applied during lesson delivery steps and processes, I started to integrate ICT in my teaching (practice).
(Interview Transcript: Adeline)

Divine narrated how she used ICT tools to bring reality into her classroom. She accessed textbooks through the Rwandan Education Board (REB) educational portal for different subjects stored in an electronic format. She described one science textbook with images and illustrations showing the different soil types. These images made the lesson presentation more comprehensible as learners easily associated the images with what they had seen in real life., thereby enhancing an easy transfer of knowledge. She stated:

For example, I was teaching types of soil, but I could not easily find the clay soil. So, I got the soft copy book that described how a loamy soil is, how a clay soil looks like and how sandy soil is. They (learners) saw people that were doing the work of craft with the clay soil and the people that were building with sandy soil. When you are using ICT, you have access to many things (resources) therefore, the teaching aids you would display are well-shaped. So, you understand there is a big difference.

(Interview Transcript: Divine)

Being able to take control of their class using ICT in terms of preparation, content mastery, lesson delivery, creation of enhanced learning experiences changed the participants' perspective about their profession and their self-efficacy. This is discussed in detail in the following category.

- **Enhanced teacher-confidence through ICT self-efficacy**

Data analysis revealed that the participants' learning experiences through the use of ICT while studying at Horeb University influenced their level of confidence in teaching with ICT. Most participants shared the same sentiment on the boldness they now have with ICT

tools in the classroom. They felt that their self-identity as confident teachers was amplified because their lesson delivery methods now included using ICT tools. They narrated that acquiring the competencies needed to use ICT effectively to enhance classroom learning boosted their confidence. Furthermore, developing a solid sense of ICT self-efficacy instilled a culture of resilience in ensuring that ICT is effectively infused into their teaching to achieve the National ICT in Education Policy goals. Longoria explained that preparing PowerPoint slides for her lessons allowed her to familiarise herself with the ICT and get a deeper understanding of the subject matter. This understanding made the lesson delivery much easier and presented her as a credible source of information to her learners.

*When it comes to using ICT for preparing especially PowerPoint. As I am preparing my presentation it makes me grasp so much, and increases my confidence; my content knowledge has really improved. The way of getting and understanding different concepts and content has changed.
(Interview Transcript: Longoria)*

Exploring the potential of different ICT tools in the classroom became easy for Yvette because her experience while learning in an ICT-supported environment gave her significant confidence to deliver her lessons and to maximise the use of ICT tools at her disposal.

*“The skills I learnt from here (Horeb University) helped me to become very confident to try even what I was afraid of trying to do with ICT tools”
(Interview Transcript: Yvette).*

Daudi enthusiastically described how possessing technological knowledge enhanced beliefs to create impactful learning experiences for his learners successfully. His ability to handle various ICT tools in the classroom gave him extreme joy, a sense of fulfilment, and confidence as a teacher. During one of my visits to his classroom, I also observed that he maintained a high level of enthusiasm throughout the lesson, as he seamlessly moved through all the steps involved in the teaching process with minimal effort.

*Confidence has increased because of increase of knowledge and understanding toward technology (ICT). Sometimes you see people doing something they are knowledgeable at, and feeling extremely confident, and so do I. You know the more you get knowledge, the more confident you become”
(Interview Transcript- Daudi)*

Oreofe also stated that in contrast to her previous mundane teaching practices, she now teaches her lessons confidently and seems to obtain the desired outcomes. Her “identity” mindset about using ICT for teaching and learning also changed. The initial mindset of the difficulties associated with using ICT for teaching and learning was eliminated, and she seized every opportunity to enhance the learning experiences of her learners by integrating ICT.

Uh-hmm, first of all, the confidence in using ICT. You know, at first, I was not feeling very confident, maybe it won't work out, or maybe my lesson will not end up the way I wanted it. So, I became very confident in using ICT in my class, and then I learnt that we can involve (integrate) it (ICT) comfortably into our lesson and give our students more ways to learn. (Interview Transcript: Oreofe)

Working in an environment that facilitates access to ICT tools for learners and the teacher, helped Divine to develop more self-confidence as a teacher at Peace Academy. The classrooms were equipped with data projectors used during teaching and learning. These ICT tools changed the context of lesson delivery and helped her prepare and present her lessons more organised and visually attractive. Her learners were fully engaged with different learning activities that increased the effectiveness of her lessons. She explained as follows:

I am using ICT tools regularly; it has become a good habit (laughter). You see, I prepare exercises on my computer, instead of writing. When I want to give the exercise, I only project from my computer and, then they (learners) continue to write. I have developed that good culture. Every teacher has his/her own computer; every class has a projector. (Interview Transcript: Divine)

Figure 4.10

Divine teaching English Language with ICT



The evidence of changed classroom practice among the participants in this study was revealed through their comments. This evidence is also reflected in their lesson planning and ascertained through direct observation of teaching activities in their various classroom contexts. Participant teachers' learning experiences with ICT at Horeb University significantly shaped their practice and transformed their pedagogy. Hence, teaching and learning became more enjoyable for the participants and their learners.

- **Transformed lesson-planning strategies**

A lesson plan is a crucial document designed by teachers to plan any classroom situation. The lesson plan guides the teacher's activities during the subject content delivery. It also indicates the resources (materials) and teaching methods required to achieve the desired outcomes or objectives for the specific teaching and learning activity. Meticulous lesson planning is a requirement for quality teaching (Vandeyar, 2020a), and every professionally

trained teacher is expected to prepare their lessons adequately before teaching. The reasons for lesson preparation include moving systematically through the delivery and to the required outcomes and ensuring that information is presented to enhance learning. Participants in this study agreed that using ICT made it easier for them to accomplish thorough lesson planning.

The in-service teachers' narratives suggested changes in their practice due to their learning experiences at the university. In contrast to previous practice, many of them now explored the potential of ICT for lesson preparation as key. Furthermore, it was evident that the internet allowed them to access more information that could be useful in their class which seemingly contributed to their confidence as they delivered their lessons. The mould and monotony of relying on one source of information, such as textbooks and old lesson plans, was broken. Similarly, access to a variety of teaching materials became easier. The in-service teachers recounted their new experiences during my face-to-face interviews with them. Classrooms visits as a non-participant observer and document analysis affirmed these narrations (see Figures 4.11 and 4.12).

Longoria explained that using ICT during preparing her lessons meant she had to familiarise herself with and understand the content first to avoid mistakes while teaching. She relied on ICT to search for relevant information to prepare adequately for her lessons.

As I am preparing, first, I teach myself, I don't want to go before a child and I start blundering, so when I want to teach about a story, I need to see the story, I need to identify different characters, I need to identify the setting. I need to see those things when I am alone so that when I go there (classroom), I am confident. and I have already motivated myself; whatever I am presenting, my face is happy because I own it then. (Interview Transcript: Longoria)

As a teacher of English, she further explained some of the specific steps that she took in preparing for a typical lesson where she had to teach "Sounds". With the use of ICT tools, her lessons became more interactive and concrete, and accessing the various resources to enhance the depth of understanding for her learners was done without much effort. Lesson planning became a more creative adventure, with her exploring the internet for suitable materials to explain concepts without ambiguity. Her descriptions indicated that she

possessed the ability to achieve her learning objectives through the appropriate use of technological content knowledge.

Ok, like I'm going to teach about sounds, uh-hmm, let me say like I want to bring in diaphragms 'ph' that is P and H, it is sounded 'ph' 'That is a phone' 'That is a photo'. I would go online, and I would get a phone (image) and I insert it into my PowerPoint presentation or word document (MS word). Then go again and look for a photo, I would bring in a photo, things that they can see, they've heard about, and used to. When I click, it (image) shows clearly. I have a phone on the ICT material (PP slides), and they have a phone in the physical form. (Interview Transcript: Longoria)

Oreofe mentioned that preparing her lessons involved thoroughly searching the internet to enrich the content she had already obtained from the textbooks. Searching for more useful information helped her to discover new and different ways of achieving her goals for teaching. This change in her lesson preparation strategies ensured that her lessons were more suitable and relevant. She commented:

The teacher gets to do research because you want to know more about the content before you actually go to class to teach it. So, there is that point of taking your time and searching; getting out of just the textbooks, out of the hard copy books that you have, for example, you need pictures, it can be printed either colour or black and white, and of course videos, so you have videos from You Tube or related websites and then you add that to the hardcopy(textbook) that you have, so the planning involves a lot of things, and you have variety of materials to make the class more interesting. (Interview Transcript: Oreofe)

Adeline described the use of ICT in her lesson preparation as an important activity she was involved in to ensure that her learners had a clearer understanding of the content. She attached significance to the adequate preparation of lessons, as this eliminated any areas of uncertainty that could hinder her lesson delivery in class.

Sometimes, when I am preparing my lessons, I face some problems that cannot allow me to explain well in my class. When I face that problem, I can sit in the smart classroom (School ICT lab) and search more information about that content in order to understand well, and I can then explain better in the class. (Interview Transcript: Adeline)

The new-found practice of supporting textbook information with supplementary information from alternative sources like the internet made Nyansani more confident of the content he presented to his learners. He attributed this skill to his experiences at Horeb as

a student. Enriching the content on a given topic through more search for relevant resources is an added value for him in his profession.

I used to teach by using only textbooks as reference but now, I will first do Google search on a topic I will teach, and extract more information related to the books provided alongside curriculum, and then I can be sure of what to give to my students. So, the life of studying at Horeb University which sparked my internet search ability helps me a lot in my teaching career now. (Interview Transcript: Nyansani)

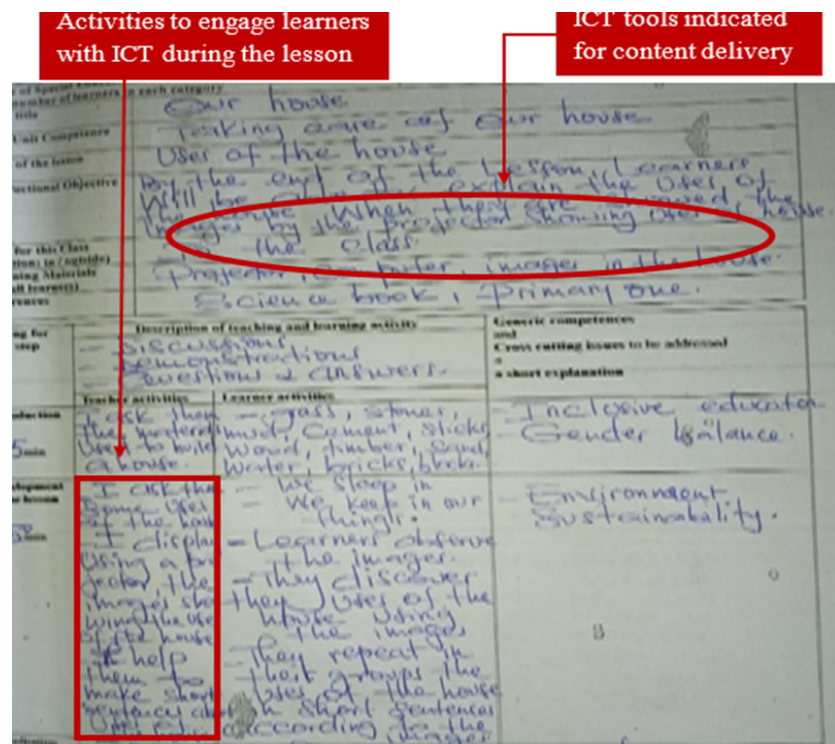
Divine also explained that using ICT in preparing her lessons enabled her to access different learning activities for the various topics she taught. She included these in her lesson plans to keep learners active in the class (Figure 4.11). It also seemed that she was able to manage her time better with regards to lesson plan preparation.

You know that in a lesson plan I need to include many parts like the objectives, the teaching material, resources, exercise and activities so when I search on the internet, I find many interesting activities available on Google, for example homework, like science homework. (Interview Transcript: Divine)

(Interview Transcript: Divine)

Figure 4.11

Divine's Science and Elementary Technology lesson plan



Highlighting how ICT would be used in the classroom while teaching in their lesson plans was a practice that emerged after the participants' various ICT learning experiences at Horeb

Figure 4.12

A sample of Daudi's SET lesson plan

ICT tools for lesson delivery		Learner activities for engagement					
Term	Date	Subject	Class	Unit N°	Lesson N°	Duration	Class size
II	18 th of 2018	SET	P4	13	1	40min	33
Type of special Educational Needs to be catered in this lesson and number of learners in each category							
—							
Unit Title <i>Human skeleton</i>							
Key Unit Competence <i>Learners will be able to describe the human skeleton and explain its functions</i>							
Title of the Lesson <i>Meaning, functions of a skeleton</i>							
Instructional Objective <i>At the end of this lesson, learners will be able to: Explain functions of skeleton, define, drawing and labeling the human skeleton and to show awareness on importance of skeleton</i>							
Plan for this Class (Location: in/ outside) <i>Inside</i>							
Learning materials (for all learners) <i>Projector, Computer, Speaker, clocks and text book of science and elementary technology for Rwandan schools (Teacher's Guide Primary Four); Internet (Youtube to download video)</i>							
References							
Timing for each step							
Description of teaching and learning activity		Generic competences and Cross cutting issues to be addressed + a short explanation					
Teacher's activities	Learners' activities						
<i>Introductory 5min</i> <i>I will introduce my lesson by project and showing learners a video</i>	<i>Learners will be attentive watching the video so that they will provide feedback on what they have seen</i>	<i>Gender education</i>					
<i>Newbody 25min</i> <i>Here in this part learners will be asked to discuss about what they have seen, where they sit and try to answer the asked</i>	<i>1) What have you seen in that video? - bones of a human body 2) (a) Can somebody move without bones?</i>	<i>Both girls and boys should be encouraged and participate in all activities done in the</i>					

- **Enhanced presentation techniques**

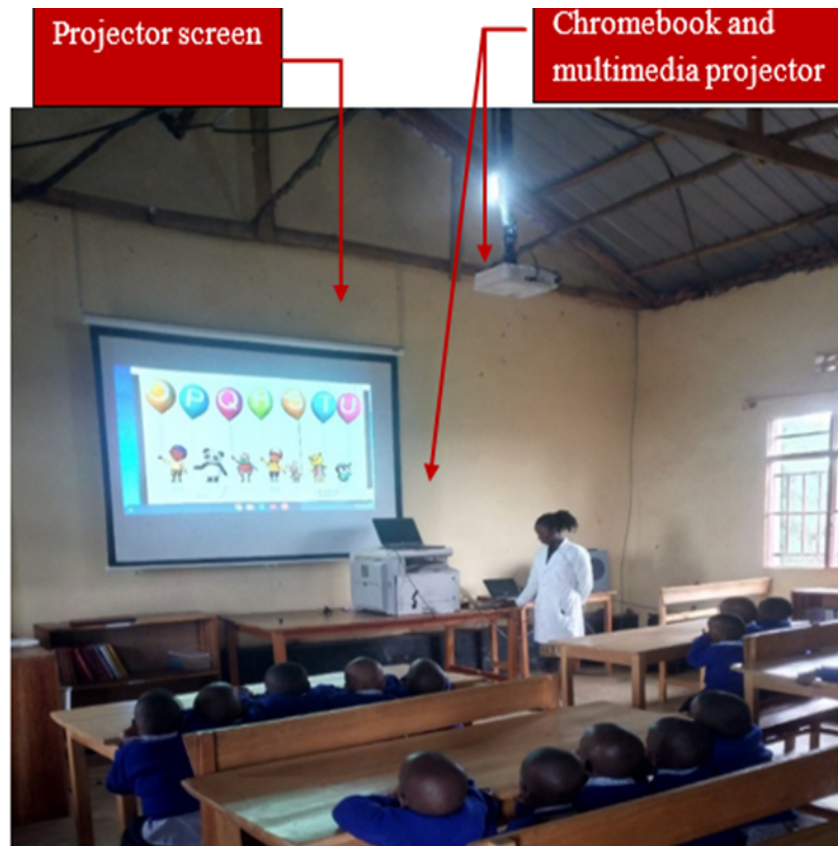
A lesson could be well prepared, however, if such a lesson lacks an appropriate method for effective delivery or presentation, then the effort of such a teacher may be considered meaningless. Delivering a well-prepared lesson with the use of ICT involved being able to identify the appropriate methods and technologies to use to create lasting and suitable learning experiences for the learners. This called for adequate pedagogical and technological knowledge on the part of the teacher. The in-service teachers in this study seemed to have developed the required skill to effectively deliver their lessons with the use of ICT as a result of their experiences at the university. This is shown in Figure 4.13. Their voices suggested that they now relied on the use of ICT to properly and effectively deliver

the lessons they prepared. Yvette explained excitedly that her practice previously was to write letters on the Manilla papers (cardboard) whenever she taught sounds, alphabets and numbers. Considering the age of her learners, between three to five years, she felt this method was monotonous and boring because her learners lacked the opportunity to interact with attractive and professionally designed learning material. However, this has recently changed as she switched to using videos or audio for her lessons. She related:

I just look at the content and then use internet information to see how I can add more or change the techniques I wanted to use if there's any other better one. For instance, if I am going to teach animals, like a cow, I search and download images of a cow and look for a video to teach how it (cow) sounds; my kids will also imitate by sounding like a cow as guided by a video. They will learn all about a cow in a video, how it eats, sounds, walks, and sleeps, everything. (Interview Transcript: Yvette)

Figure 4.13

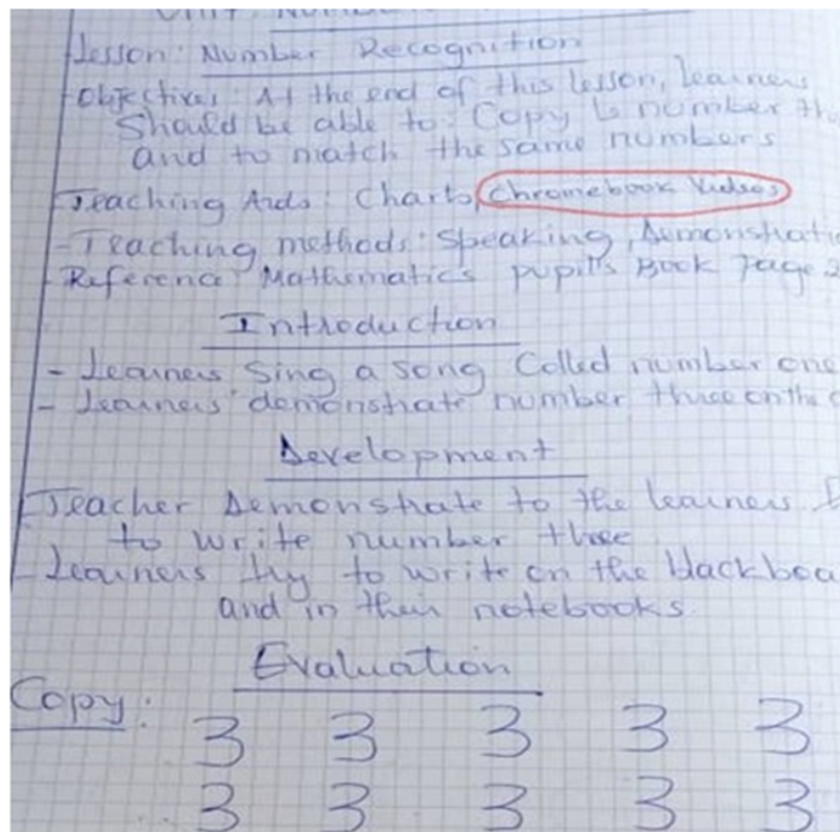
Yvette teaching a reading lesson with ICT



She explained that delivering her lesson was better, and disparate from her previous traditional approach. She felt that the use of ICT afforded learners a new experience and made her learners more attentive during her lessons. The procedure for integrating ICT into her lessons was confirmed through document analysis. I accessed Yvette's documents (lesson plan and scheme of work), which confirmed what she said during the face-to-face interview (Fig 4.14). ICT usage was reflected in the lesson plan, which indicated how it would be used during the lesson delivery. Figure 4.14 depicts a sample of the lesson plan she used to teach numbers.

Figure 4.14

Lesson plan showing ICT use in lesson delivery

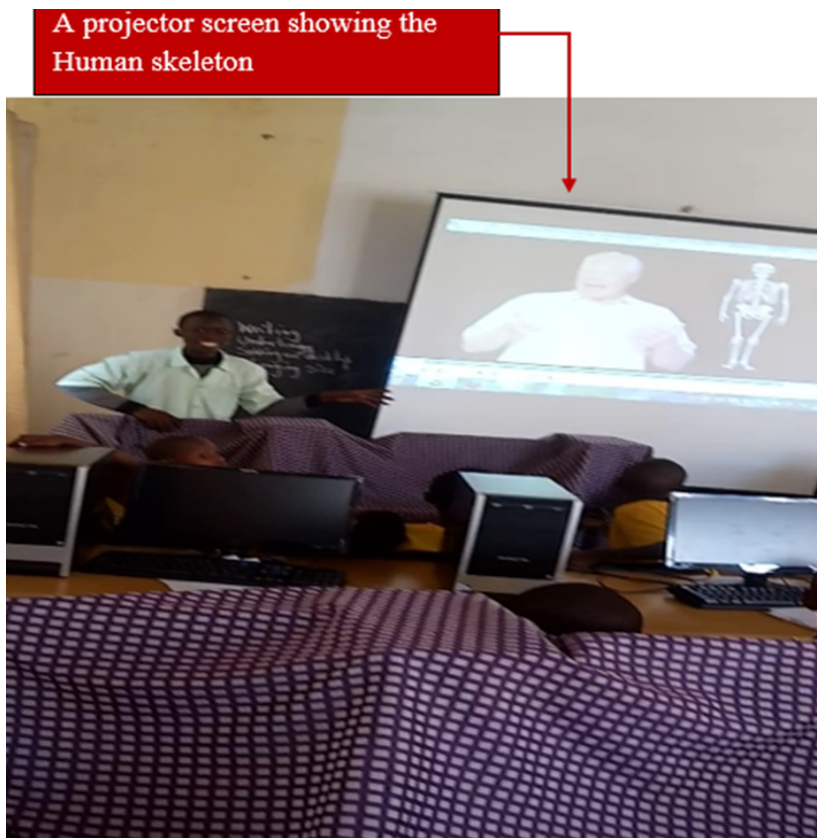


During one of my visits to Daudi's class for observation, where he taught a topic on "The Human Skeleton", his display of technological and pedagogical knowledge contributed to the meaningful delivery of the lesson. He carefully indicated how he would use the material

during the lesson, and showed the internet source of the video as well. The lesson began with the learners watching a short video on the “Human Skeleton”. The video provided useful information on the concept with a combination of sound, images and voice. The learners watched with undivided attention as the scene captivated them, allowing them to assimilate the content effortlessly. After that, Daudi asked some learners to briefly describe what they had seen, allowing individual learners to explain what they gained from watching the video. During the evaluation, the learners answered the questions excitedly and could easily identify the different types of bones in the human skeleton. The use of ICT for a more engaging and interesting lesson delivery in Daudi’s class was captured in Figure 4.15

Figure 4.15

Daudi in the computer room with his learners



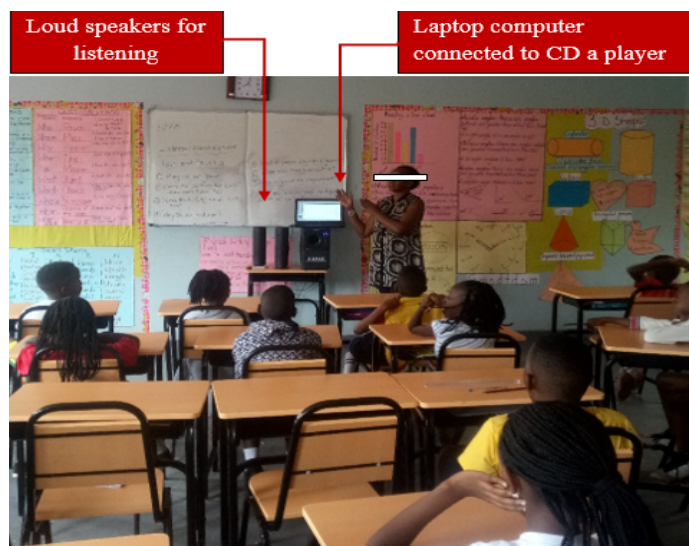
Longoria, who taught English to primary four learners at Oaks school, shared the difference in her practice with me as she delivered her lessons with ICT. She expressed feeling

fulfilment as a teacher in imparting adequate knowledge to her learners due to the new experiences that she was able to create for them with the use of ICT in the classroom. The observations I made during her classroom teaching indicated a similar scenario to that of Horeb University. ICT tools were used to convey the subject content during teaching, and varied tools were used depending on the subject or topic taught at a given time. During a visit to Longoria’s classroom, she taught “Listening Skills” in a lesson on “Yawning”. As part of the lesson, a pre-recorded audio clip was played for the learners by connecting a laptop to the speaker with a USB cable. These devices were set up in front of the class for better audibility (Fig 4.16). The learners listened to the clip attentively as it played out over the speaker, and I observed that some of them scribbled some notes as the audio clip progressed.

You know, when you are still in the other side of the coin (without ICT) when it comes to reading stories to these people (learners), you have to use different tones; if it is a bear, you start talking like a bear, if it is Mum, start talking like Mum. Now here you are in another era where it is digital (with ICT); you know with technology you can create voices you can use different tones. (Interview Transcript: Longoria)

Figure 4.16

Longoria teaching “Listening” with ICT



Adeline explained how she used ICT in delivering the content in science when she taught “Air Pollution”. She felt the lesson would be understood if she presented it more visually and interactively. Therefore, she used a video presentation depicting how the air in the environment gets contaminated by human activities. Through the video, learners could identify the specific activities that contributed to global warming and appreciated the importance of desisting from such activities. The video visualized and concretised otherwise abstract concepts that would have been vague or unclear to the learners.

On air pollution after defining air pollution, we studied the consequences and causes of air pollution, we studied about Global warming, so I used the video that showed “the greenhouse effect”, the global warming. How can air pollution cause global warming, how can Global warming affect the Ozone layer? The video of global warming I searched and I watched it with my learners. (Interview Transcript: Adeline)

The competence developed in using ICT tools for teaching and learning by the participants in this study after their experiences at Horeb University subsequently influenced their teaching methods and approaches in their classroom. The effects are described in the next sub-category.

- **Embracing constructivist teaching approaches**

Lessons were delivered through methods that allowed learners to actively and purposefully engage in the classroom. Daudi seemed to understand what pedagogy changes demanded and how the use of ICT helped him to achieve it. His explanation centred on properly-thought out lesson planning or preparation and the use of appropriate teaching or delivery methods which showed the interdependence of teaching on learning and vice-versa.

When you are talking about pedagogy, you talk more about teaching methods, what we teach and the way of teaching them. Let us start from what we teach; as teachers, we have to prepare subject contents which is appropriate, complete (accurate), and enough (sufficient) for the learners. As we use ICT, it helps us to prepare appropriate, and complete content. Then methods, many times, you may even not know how you can teach a certain lesson for example, but when you go and search the internet, you can be advised on how to teach the lesson without frustrating the learners, starting from simple to complex. (Interview Transcript: Daudi)

Initially, Yvette encountered several significant challenges while teaching, including getting her learners to understand fundamental concepts, especially in Mathematics. Her previous traditional teaching methods denied her learners the opportunity to participate in the learning process. However, she overcame the challenge by selecting more age-appropriate and suitable methods of delivery that not only allowed learners to co-create knowledge in the classroom, simplified the teaching process, and made learning more interesting to the learners.

I think you saw it the other day you came, I don't even think about teaching without ICT because it can be difficult, and it's awful to see my kids (learners) spending the whole time passive. I never knew pedagogy before joining Horeb, like applying HIPHOP so that my learners can get the content in a funny way. Before, it was hard for my kids (learners) to understand. But with HIPHOP my learners master the content in an enjoyable and collaborative way, moreover, it (ICT) helps me to explain (different concepts) to them easily during teaching. (Interview Transcript: Yvette)

Oreofe narrated that her teaching now takes on a different dimension with the use of ICT. Through different inquiry and discovery methods, she engaged her learners in learning activities that allowed each learner to interact with ICT in the classroom to explore the world beyond the classroom walls. This changed the perspective of her learners about learning, and she, as a teacher, enjoyed guiding them to access various sources of information to build new knowledge into existing schemas. Achieving her objectives was seemingly effortless because each learner had access to individual iPads with internet connectivity which helped to accomplish all ICT-related classroom tasks. She explained:

The teaching process also has been made more fun, the part of involving the student, making it more learner-centred. Uh-hmm. Okay, for instance, we were working on "Evolution and Inheritance" So, they were supposed to find out about different dinosaurs and the theories that scientists think led to dinosaurs being extinct. So basically, you know, they go deep (purposeful search) into finding out this information, and everyone had to come up, and tell others about their theories and why did they decide to choose a specific dinosaur, and they had to draw it. (Interview Transcript: Oreofe)

Sharing the same sentiments as Oreofe, Sylvester explained that using ICT has changed his pedagogy. He related that he now used more advanced and learner-centred methods, such

as inquiry learning, while teaching. These methods gave his learners the opportunity and freedom to make individual efforts in seeking knowledge with guidance from the teacher.

Well, before I came here (Horeb University), I was using the skills (teaching methods) that I got from secondary; they were less advanced. Some of my lessons plan and scheme of work were not advanced like it is now. I now know how to use Process Guidance Inquiry Learning (PGDIL) in my class, which is inquiry learning to make students achieve learning goals. I got this from Horeb University; before, I would go to the class using the old method that teachers were using traditional (chalk and talk) method. (Interview Transcript: Sylvester)

Adeline prioritised engaging her learners in activities that required them to use ICT during her lessons, allowing them to learn by doing. The different learning activities helped to put the learners at the centre of the learning process. Similarly, interaction among students was improved because they had to accomplish various tasks while working together. This is depicted in Figure 4.17 captured from her class.

I give activities that learners can do with ICT. For example, in that laptop (OLPC) we have the program of writing skills. On this laptop (pointing to my computer) it is called Microsoft Excel; on that computer it is called Writing skills. Learners can draw a table and fill the names, and marks, then do a total or average ... such activities. I draw that table on the chalkboard, and ask learners to write in the computer and make a sum, average, minimum, and maximum etc. (Interview Transcript: Adeline)

Figure 4.17

Learners in Adeline's class using the OLPC laptop



In comparing her previous practice without the required competence to use ICT in her class with the present methods that she now employs, Divine recounted that the monotony of teacher-centred methods was eliminated. The learners engaged more in activities that allowed concrete learning to occur in the classroom. She accessed ready-made learning material from the Rwanda Education Board (REB) portal through search engines such as Google. This portal contained resources and tutorials for teachers and learners to use during lesson delivery. She accessed different learning materials for various subjects, such as Art, Science and Mathematics. Some classroom activities that her learners engaged in included puzzles, drawing, and searching for different information on different subjects from the learning apps installed on their iPads, and more.

You know, before you can see a teacher going to class and talking only, and she is dominating the class, but now with ICT, there are many activities, because of those materials from Google and the exercises, learners now get

more time in the class. The higher percentage of time is spent on activities by the learners instead of the teacher. (Interview Transcript-Divine)

With ICT, in-service teachers were motivated to explore more learner-centred methods of teaching effectively, which helped in achieving their goals and objectives more easily, it also assisted learners in assuming more responsibility for their learning.

4.4.3 Teacher resilience

Despite the contextual challenges, such as the lack of ICT tools and infrastructure, and unstable electricity supply, teachers seemed determined to persevere in using ICT for teaching and learning. The participants in this study sought ways of overcoming these challenges and forged ahead in their decisions to produce competent learners for the 21st century workplace. This category discusses some of the initiatives taken by in-service teachers.

Possessing the required competencies to create valuable learning experiences for their learners through ICT helped the in-service teachers persistently seek solutions to any problems they faced daily. The problem of a lack of ICT tools, as depicted in their comments, was a major factor that hindered their practice. The in-service teachers, therefore, devised a strategy to overcome this by allowing the learners to bring personal devices to the school for learning. The learners brought devices such as Ipads and laptops to the school on certain days in agreement with the parents. Oreofe further explained:

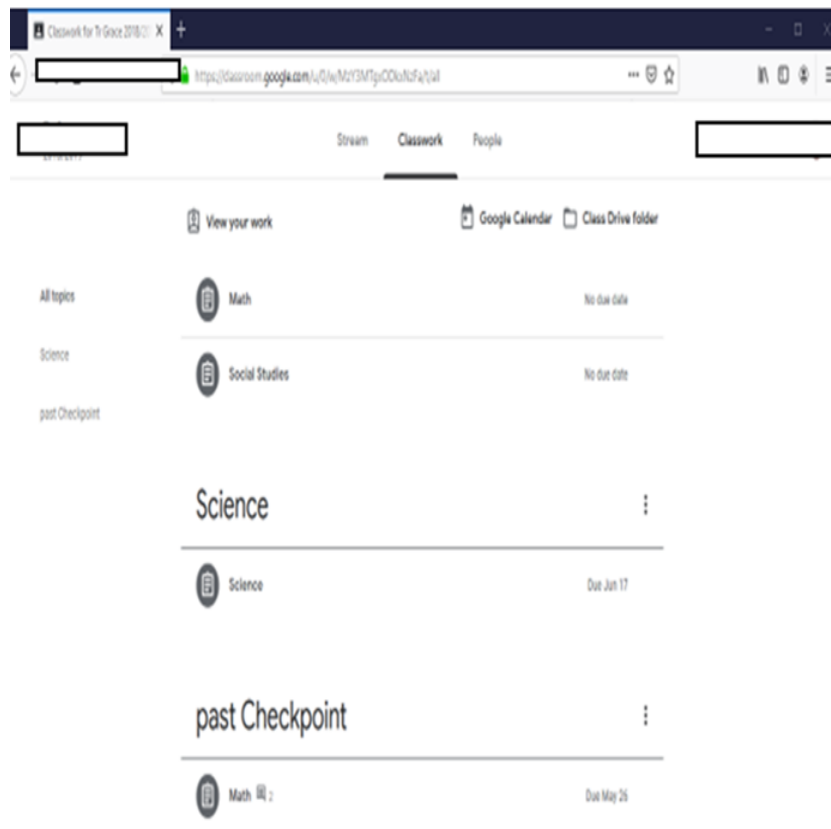
“Learners have their own devices like phones, laptops and ipads which they bring to school on particular days, so I engage them through the Google classroom” (Informal conversation: Oreofe).

Longoria confirmed:

They (learners) bring their parents’ laptops and ipads to the school. I ask them to bring it so that each on can have an ICT tool to work with during the lesson. They search for information or do class activities with the devices. (Interview transcript: Longoria)

Figure 4.18

Screenshot of Oreofe's Google Classroom for collaboration and self-study



As a reflection of her experience as a student at Horeb University, Oreofe also engaged her learners through Google Classroom (see Figure 4.19). She used the platform to create an opportunity for collaboration and self-study for her learners. I was invited to participate in her class as a non-participant observer; hence I could follow what transpired between the learners and the teacher in terms of learning.

Similarly, Adeline, who taught Science and Elementary Technology (SET) for two periods a week, described how she managed to spend more time with her learners interacting with ICT tools. She explained that she arranged for her learners to visit the ICT laboratory (Smart) room on Fridays after the lunch break. According to the school timetable, this time is free for the learners. She did this to ensure that her learners became more confident with ICT tools and thereby improve their skills.

Before I used it only two periods in my class, but now on Fridays, on the timetable, we have the hour when the learners are free. We come, we put up

the computers from that cupboard, it is not an organized lesson (not on the timetable), the learners sit and search what they want, in order to feel free (familiarize) when we put the machine(computer)in front of them. (Interview Transcript: Adeline)

4.5 Summary of findings

The findings of this study point to several interesting occurrences in the participants' learning experiences. While the major aim of engaging in further studies by the in-service teachers was to improve their knowledge of different areas of subject matter or specialisation, there were unintended outcomes. Firstly, receiving instruction through ICT tools such as Smart TVs, projectors, computers, LMSs, Google class, and YouTube at Horeb University facilitated productive and effective learning. Students could develop new ICT skills required for performing more effectively in the classroom. The participants became ICT competent through the learning activities they were engaged in at the university as teachers-in-training. This impacted their perceptions and belief about using ICT to create appropriate learning experiences for the learners in their classrooms.

Secondly, the in-service teachers “learned how to learn” through ICT. Individual completion of assignments and group tasks for class presentations gave them chances to explore and seek knowledge by themselves without being dependent on the lecturer. The learning was more constructivist, and the teacher-students adapted to taking responsibility for their own learning. The learning experiences in the ICT-supported context at Horeb University equipped the participants with new skills for purposeful, active, interactive and self-directed learning. Hence, though they intended to become better at their profession, the participants acquired learning skills that did not only help them as students but also changed their beliefs and perception about learning. Engaging in active and collaborative learning facilitated a changed attitude.

Significantly, the participants in this study experienced noticeable changes to their teaching practice after studying at the university. The participants' narratives revealed that learning experiences were better and disparate when ICT was employed in the lectures. This viewpoint became a major contributing factor to the use of ICT for teaching and learning in their individual classrooms. The in-service teachers replicated good practices in what

they experienced as in-service teacher-students. They went back to their classrooms with new ICT-enabled pedagogical strategies and techniques. These experiences served as a catalyst for pedagogical change in their classrooms. Hence, various aspects of their classroom practice and teaching strategies were modified to fit the demand of the changing landscape in teaching. Classroom practices, including researching and presenting knowledge, also encouraged learners to independently seek knowledge with the teacher as the facilitator of learning. With a focus on a more constructivist approach to teaching, the in-service teachers engaged learners in activities that allowed the development of skills and critical thinking.

Thirdly, the in-service teachers developed a sense of resilience as ICT agents of change because these occurrences took place amid different school environments, which ranged from ICT conducive to totally hostile environments. The different school contexts and lack of uniform policies on using ICT in the classrooms led to the participants encountering various challenges. However, their passion for teaching with ICT was not diminished. Some of the limitations faced by the in-service teacher included ambiguous and unwritten school rules and often orthodox regulations, insufficient tools to facilitate learning, and unstable electricity supplies.

However, some school administrators ensured that their teachers participated in different ICT professional development activities facilitated by experts in either face-to-face or online training platforms. Professional development thereby contributed to sustaining transformations in the pedagogical practice of the in-service teachers.

I conclude by indicating that the changes in the teaching and learning landscape demand a generation of teachers who can strategically position themselves for adjustments, transformation, and improvement in pedagogy. Remaining relevant in education requires moving in the directions dictated by the permeation of ICT in the classroom. As indicated in their narratives, the participants' experiences in this study crystalised their knowledge of the importance of embracing change. Thus, this formed the basis for their decisions to transform their practice for the 21st century teaching through ICT integration.

5 CHAPTER FIVE ANALYSIS AND DISCUSSION OF FINDINGS

5.1 Introduction

This chapter presents a synthesis, analysis, and discussion of the study's main findings this study as reported in the previous chapter. The patterns that emerged from the ICT learning experiences of the in-service teachers are emphasised. The findings regarding the in-service teachers' journey of self-reinvention, navigating learning in an ICT-supported context, two worlds apart and teachers as ICT agents of change are also synthesised and discussed. In a thorough engagement with the extant literature, I reflect on my research findings in light of the literature in the field by illuminating whether the findings and results substantiate or refute current perspectives. Furthermore, I interrogate my findings reflecting on Activity Theory as the principal theoretical framework chosen from relevant theories in the literature. This chapter also critically engages, interrogates, and interprets the research findings.

5.2 Revisiting the research questions

This thesis investigated how information and communication technology as a tool of instruction for in-service teacher training at a HEI influenced the classroom practice of in-service teachers. This study was guided by one main research question and two sub-questions to explore this phenomenon. These questions were targeted at ascertaining the learning experiences of in-service teachers in an ICT-facilitated teacher training context and determining how these ICT learning experiences translated into changed pedagogical practice in the classroom. I chose to view this phenomenon holistically through the lens of the Activity Theory Framework. The model facilitated a comprehensive grasp of the independent and interdependent elements within the Activity system.

Four themes emerged from the research findings through *a priori* (Saldaña, 2014) coding and analysis. The identification of the themes was based on the analysis of data garnered through classroom observations, interviews, document analysis, and field notes. The first theme examined why and how the in-service teachers decided to further their studies at the university. I described this theme as "*an inevitable journey of self-reinvention*". The second theme explored the ICT learning experiences of the in-service teachers in the

university through which they were “*navigating learning in an ICT-enriched context*”. The third theme described the schisms between what transpired in the university learning context and the school teaching context, described as “*two worlds apart*”. The fourth and final themes revealed the induced changes or transformation to the practice of the in-service teachers as influenced by their ICT learning experiences at the university; the theme is captioned as “*teachers as ICT agents of change*”.

The findings of this study indicated that the variety of ICT learning experiences that the in-service teachers had at Horeb University catalysed the transformation of their pedagogical classroom practices. The in-service teachers acknowledged their expectations to develop a generation of learners required for the 21st century workplace. Therefore, the in-service teachers felt a sense of professional responsibility to embark on a journey of self-reinvention to empower and prepare themselves for the task. The journey's progress facilitated them with significant learning experiences, more specifically with ICT. They experienced learning in a new way; learning became more engaging, deeper, interesting, and active. Hence, the in-service teachers sought to create an opportunity for the learners in their classrooms to experience learning similarly. Additionally, the data analysis showed that in-service teachers' interaction with ICT tools increased their engagement level and allowed them to take more responsibility as students, facilitating a more constructivist approach to their learning.

Finally, the results of the study suggest that the interplay among the elements of the Activity Theory such as object, tools, rules and regulations, and the community, influenced the overall process of the pedagogical transformation of the participants' practice. A strengthened sense of resilience was instilled by the in-service teachers in their determination to enforce change within their school context. This gave rise to the participants adopting several initiatives to meet learners' ICT needs and achieve meaningful and impactful pedagogical changes within their classrooms. The four major themes that emerged from the results are discussed in the following section.

5.3 Analysis of the emergent findings

The in-service teachers in this investigation gave different accounts of how their experiences at the university influenced their classroom practice and how their pedagogy

has been transformed by using information and communication technology. These changes were ascribed to their ICT learning experiences as students at Horeb University. The in-service teachers returned from their role as students at Horeb university to their classrooms and utilised the newly acquired ICT skills in their practice. Furthermore, they explored the potential of online teaching and learning resources such as the internet, Google Classroom, educational portals and websites such as the Rwanda Education Board (REB) e-learning platform, and many others. The in-service teachers engaged in all these ICT-enabled activities to ensure that their content knowledge was enriched with adequate information. They employed sufficient and appropriate learning activities to provide their learners with the required learning experiences to develop the necessary skills for the future workplace.

Four major patterns of experiences were identified in this study to describe the ICT learning experiences of the in-service teachers and the outcome of learning at the university, which initiated changes in their classroom pedagogy with ICT. The first pattern focused on the various “new” experiences of the in-service teachers while studying in an ICT-rich context at a HEI and how the in-service teachers developed the ICT skills needed to navigate such an environment successfully. The second pattern concerns the pedagogical shift from traditional teaching methods to ICT-enhanced classroom practices that reflected their learning experiences at Horeb university. This pattern included changes to daily practice with ICT in the classroom, involving lesson plan preparation, embracing constructivist teaching and purposeful assessment methods. The third pattern focused on the institutional challenges encountered within the participants’ various schools, and the influence of the different school contexts on the practice of the in-service teachers. Finally, the fourth pattern focused on the resilience of the in-service teachers to overcome challenging situations or contexts and pursue enhanced learning experiences, improve ICT pedagogical practice and produce learners that are apt in the 21st century workplace.

5.4 Echoing the extant literature: Similarities

The data analysis revealed that there are some uniformities between the findings of the current study and that of existing literature. This section discusses how the present study’s research findings confirm what is already known in the extant literature. This is

accomplished by highlighting the similarities under the emergent themes identified to be coherent with literature research findings.

5.4.1 *An inevitable journey of self-reinvention*

- **The need to be ‘ahead of the curve’**

The role of teachers and the school in preparing learners for a changing and challenging society is crucial and cannot be overestimated. Therefore, preparing learners for the future workplace requires a generation of willing and ready teachers to position themselves strategically for lifelong learning. This study revealed that although the in-service teachers were already employed and practicing in the classroom, a self-scrutiny of their subject content knowledge and expertise revealed knowledge gaps that needed to be upgraded. The in-service teachers believed that closing their subject knowledge gap would help them to remain curriculum relevant and to keep abreast of the constant curriculum changes in the teaching landscape. According to Gemedda and Tynjälä (2015), teachers engage in life-long learning to keep up with changes in the field. Similarly, Day (2013) argued that maintaining the continual effectiveness of teachers in the classroom requires updating and refining their intellectual needs, such as knowledge of subject matter and pedagogical content knowledge through formal education programmes. Remaining relevant in the 21st century classroom requires teachers to be proficient with ICT. Teachers should possess skills with which they can access resources that help to increase the quality of teaching and learning.

The participants' narratives in this study revealed two crucial factors that motivated the in-service teachers to re-invent themselves through further study. Firstly, the in-service teachers continually strove for excellence in their practice; they wanted to become better teachers. Secondly, they were genuinely interested in preparing their learners for the 21st century workplace, hence the motivation to acquire the skills needed to remain relevant in the teaching profession. These realities prompted the participants in this study to enrol for further studies at Horeb University with expectations to improve on subject matter knowledge and to become better teachers.

This finding is credence to the earlier findings of Appova and Arbaugh (2018) who aver that teachers engage in further learning because they want to improve. The authors also

found that dissatisfaction with their own teaching motivated teachers to learn. This desire was explored through regular scrutiny of their classroom practice and constant comparison between their techniques or methods of teaching and the desired way of teaching. The authors found that in-service teachers were frustrated with their previous practices and were left with a feeling of inadequacy. This served as motivation to engage in professional learning. This viewpoint is also affirmed by the argument of Hennessy, Harrison, and Wamakote (2010), who posited that teachers who lack the opportunity to develop themselves feel threatened and lack confidence. The extant literature findings are similar to the in-service teachers in the current study's experience, who viewed themselves as outdated and lacking required content knowledge skills as a threat to their existence and survival. Therefore, to be well-informed subject teachers in the 21st century classroom became a function of self-determination to develop and improve.

- **Professional development**

Darling-Hammond et al. (2017) described professional development as diverse educational opportunities which provide experiences related to an individual's job and targeted towards improving practice. In education, professional development is usually aimed at improving teaching and enhancing student learning. It allows teachers to familiarise themselves with and adjust to the changes or trends occurring within the contexts in which they find themselves. The current study revealed that the personal decisions the in-service teachers made to further their studies as a form of professional development complemented the teacher professional development activities initiated by the schools where they were employed. However, the professional development initiatives provided by the schools were irregular and inadequate to support the needs of the in-service teachers.

In this study, decision-making, planning and implementation of professional development programmes were vested in the leadership and administration of the different schools. Thus, the leadership and administration decided the nature of the professional development content, periodicity, and duration of the teacher training. The current study's findings revealed that the interval between professional development activities was too long and irregular; hence, the knowledge gained from such training was difficult to sustain the participants. This finding is similar to that of Ajani (2021), who found that professional

development training activities for in-service teachers were inadequate if it was irregular. In-service teachers in the study criticised the irregular and inadequate nature of the professional development training they received at school. Furthermore, they perceived professional development training as unsatisfactory as many only attended the training once in a two or five-year period. Ajani (2018) posited that the paradigm shift in teaching and learning requires teachers to familiarise themselves with the availability and use of ICT tools. This can only be achieved through regular and sustained professional development activities.

I argue that in a landscape characterised by constant change, leaving teachers without constant training and retraining may result in unsatisfactory performances. Therefore, education stakeholders should prioritise professional development to ensure that teachers remain relevant with the requisite skills and knowledge for effective classroom practice. Improving the quality of technology-enabled instruction demands that in-service teachers be constantly exposed to professional training to improve practice and hone acquired pedagogical skills continually. This type of training contributes greatly to the effectiveness of ICT use in the classroom (Dlamini & Mbatha, 2018). Tondeur et al. (2016) argued that teachers' participation in technology-enabled professional learning helped them to adopt teaching approaches that are empowered by ICT to engage learners actively in more authentic activities in the classroom.

5.4.2 *Navigating learning in an ICT- enriched context*

- **Face-to-face lecture experiences**

Face-to-face contact lectures are the most common teaching method in teacher training institutions. In this scenario, students' experiences are characterised by being passive recipients of knowledge and content memorisation, thus inhibiting deeper learning. However, with the use of ICT-supported teaching strategies during lectures, this concern may be mitigated. In the current study, the in-service teachers' experience changed how they perceived face-to-face lectures. The in-service teachers in this study were found to have a positive perception towards learning with ICT as it enhanced their learning experiences. They perceived ICT-supported lectures as engaging, interesting, and concretised, making their learning authentic. For example, Oreofe's experiences of

learning with ICT made her more involved in the process, and she concentrated more during the lectures, thereby achieving increased levels of acquiring new knowledge or learning. Through viewing and analysing YouTube videos, animated images and audio conversations during face-to-face lecture sessions, active participation was achieved, and the learning experiences of the in-service teachers were improved.

This finding echoes Zweekhorst and Maas (2015), who found that students perceived ICT lectures as more effective and engaging. Thus, students acknowledged the value associated with learning with ICT. Gómez-Carrasco et al. (2020) also found that students' positive in-class feedback and participation increased when lecturers used a flipped-class lecturing mode. In their study, students watched videos produced by lecturers beforehand and came back to face-to-face discussion and analysis. In the contact lectures, the in-service teachers in the current study were not subjected to the flipped-class mode of teaching per se. However, they had the opportunity to view various relevant videos during the face-to-face lectures. This opportunity allowed them to analyse and critique the videos related to their different subject areas of specialisation and then contribute their ideas during the class discussion.

Scholkmann's (2017) research found that the illustration of the subject content with different resources through PowerPoint slides allowed for a more understandable explanation of concepts from the different perspectives of the subject content. Also, ICT integration enriched the presentation of course content because audio-visual multimedia appealed to most students. ICT-integrated lectures also reduce boredom and encourage more active participation. Similarly, in the current study, the in-service teachers were also willing to use ICT for informative and practical purposes because of its value and the possibility of strengthened deeper learning. Learning through ICT was perceived as a positive experience, and students seemingly achieved autonomous learning.

- **Self-directed learning with ICT: Learning how to learn**

Self-directed learning is unarguably one of the competences teachers must develop due to the rapid ICT changes impacting the teaching and learning landscape around the world. A technology-enhanced environment exposes learners to new methods of instruction; hence learners are challenged to “learn how to learn” in such environments. The ICT experiences

of the in-service teachers at Horeb university presented an exceptional opportunity to “learn how to learn”, achieving autonomy over what, when and where to learn.

The in-service teachers in the current study participated in a blended mode of learning which included face-to-face lectures, the online use of the Sakai learning management system, and the Google Classroom platform. These learning modes were adequately fostered at Horeb university, which helped students to take responsibility for their learning with the aid of the available ICT resources. The new learning experiences reshaped the perspective of the in-service teachers towards learning and helped them to develop a willingness to achieve their learning goals. Compared to their previous experiences as learners in schools and teacher training colleges where passive learning and the consumption of knowledge was the norm, the in-service teachers in this study engaged in self-directed learning. This learning experience provided them with an opportunity for more active involvement in creating and co-creating knowledge.

Significantly, motivation played a key role in students’ engagement in effective self-directed learning activities. As mentioned previously, the principal motivating factor for the participant in-service teachers in this study seemed to be their desire to gain mastery of their subject specialisation and become better teachers. Hence, taking responsibility for their learning seemed to occur seamlessly, albeit their learning with ICT was characterised as a “steep learning curve”. The quest for improved subject knowledge stimulated their engagement in different learning activities that increased their comprehension of study materials and resources. The in-service teachers in this study engaged in deep learning, characterised by constructive analysis and synthesis of learning material. This finding is consistent with Geng et al. (2019), who found that self-directed learning aided with learning technologies directly impacted students’ cognitive abilities and the effectiveness of learning in a blended learning environment. The authors argued that self-directed learners tend to be more actively engaged in the learning process and develop the ability to adapt their learning through “how to learn” methods.

In the current study, learning in a technology enriched context thrust the in-service teachers to develop new learning strategies. This finding is similar to that of Sumuer (2018), who

posited that a technology-enhanced learning environment contributes to college students' readiness to engage in self-directed learning. Similarly, through self-directed learning, the in-service teachers in the present study unbound themselves from the limitations of past passive learning experiences where they relied solely on lecturers' subject content knowledge. The in-service teachers were given an ICT-induced opportunity to explore what to learn. Constant interaction with ICT at Horeb university provided a conducive milieu for the in-service teachers to set learning goals and complete tasks that ensured the achievement of those goals.

According to Morris (2019), self-directed learning presents a benefit of a move towards self-actualisation and long-term success in chosen professions. This self-actualisation to become constructive learners was also evident in learning for the participants in the current study. Self-directed learning is underpinned by the principle of constructivism, espoused by Fosnot (2013), which is a theory about knowledge and how one comes to know. Constructivism allows learners to be actively involved in learning, thereby negotiating understanding in light of their experiences in a new learning situation (Amineh & Asl, 2015). ICT self-learning experiences significantly impacted how in-service teachers understood and made meaning of their learning. Learning is described as acquiring new skills and knowledge through experience, usually characterised by interacting with different components of the environment. Learning experiences, whether positive or negative, are strongly linked to expected outcomes and the eventual application of the acquired knowledge or skills.

5.5 Differences from the extant literature

The data analysis also revealed that some findings of the current study differed from those of the extant literature. In this section, I focus on the dilemma that emerged under some themes, which seemed to differ significantly from the findings of other empirical research studies.

- **Abandoning the university's Learning Management System**

The Sakai e-learning platform is a popular learning management system (LMS) in higher education systems, predominantly in Africa (Dube & Scott, 2014; Kaewsaiha, 2019). Many

HEIs have adopted LMS to support teaching and learning, especially during the COVID-19 pandemic. The situation at Horeb University was no exception; Horeb university introduced Sakai as a learning management system (LMS) to augment teaching and learning activities on and off campus with educational technology. In the current study, the LMS essentially served an administrative purpose of all forms of management, including record-keeping and tracking of students' progress. The learning management system served the student and staff community of Horeb university for learning and teaching and communication across all the university's campuses located within East Africa.

However, the constant frustration with the LMS compelled the participants in this study to abandon the institutional learning management system. Students from the Rwanda campus deserted the Sakai LMS because it failed to meet their expectations of supporting their learning. The LMS technology failed to perform as expected. This was particularly evident when assessment submissions were due, as high user traffic caused the LMS to respond slowly or even crash occasionally. Additionally, notable factors contributing to the abandonment of the university's LMS included the lack of awareness of the LMS system and students' feelings of distress and isolation.

This finding contrasts with that of extant literature (Arhinful, 2016; Gonçalves & Pedro, 2012; Islam, 2014), much of which indicates that students tend to embrace the LMS because they find it useful in meeting their learning needs. Arhinful (2016) found that students were comfortable with using the Sakai LMS for learning and adapted quickly to the platform due to its perceived usefulness, as it allowed for faster and easy access to updated information and resources. The study employed the UTAUT model (Venkatesh et al., 2003) to explore students' experiences with the Sakai LMS and found that students were satisfied with the ease of use associated with using the Sakai LMS platform.

This study's findings also do not align with that of Darko-Adjei (2018) who posited that sufficient awareness created for the Sakai platform contributed to students' adoption and use. The channels used by the university to create adequate awareness for the platform included the university's handbook, website, notice boards and lecturers. The high level of

awareness contributed to the platform's successful adoption by the Ghanaian Department of Education as a mode of course instruction to support the face-to-face method. Furthermore, students in Darko-Adjei's (2018) study were aware of the platform itself and of the embedded learning tools such as quizzes, tests, assignments and chat features. Gonçalves and Pedro (2012) also reported an increase in the number of students registered in the LMS platform at the University of Lisbon within three academic years. These students readily accepted the innovation of the use of LMS because they perceived it to be user-friendly. In contrast with the current study's findings, Holmes and Prieto-Rodriguez (2018) found that undergraduate teacher education students rated the interactive nature of the LMS highly. The students particularly registered their preference for the online quizz feature because it focused on content and provided automatic feedback.

Contrary to the literature, students in the current study abandoned the university's LMS platform because it was not useful or easy to use. I argue that higher learning institutions must advocate and create adequate awareness of any form of ICT adopted for teaching and learning, as this would assist in achieving the adoption's goals, objectives or purpose. Selection and implementation of ICT for teaching learning should be informed by its users to avoid a repetition of the scenarios of technology abandonment and resistance.

- **Adopting 'Google Classroom' as a cloud-based learning management system**

The findings of the current study suggest that Sakai as an LMS did not support or meet the learning expectations of the in-service teachers; thus, they sought other technology alternatives. Out of frustration borne from not being able to maximise the potential of the Sakai LMS, students from Horeb's Kigali campus opted for using Google Classroom as an alternative open-source courseware teaching-learning platform. The participants' prior experiences with other forms of ICT for learning facilitated the easy transition, acceptance and adoption of Google Classroom. They sought alternate technology-enabled opportunities to collaborate, contribute and enhance meaningful learning through participation. Thus, taking charge of their own learning and choosing what, when, and where to learn significantly encouraged them to explore the technology affordances of Google Classroom. In this study, Google Classroom facilitated effortless and effective

collaboration and communication for students and lecturers. Through Google Classroom, students in the current study explored and experienced flipped classrooms as some lecturers shared learning material before face-to-face sessions.

In light of the above, some findings of the current study contrast with the literature. Azal and Iqbal (2018) posited that lecturers disliked the Google Classroom platform due to the unfriendly user interface. Similarly, Rosida (2022, p. 3), stated that students found the interface of the Google Classroom platform to be “unattractive” thereby discouraging students from being active and frequent users. Priyadarshani and Jesuiya (2021) also found Google Classroom to be the least used teaching and learning online tool by undergraduate teachers during the COVID-19 in comparison to other types of LMS software. In a study that focused on the advantages and disadvantages of Google Classroom, Zakaria, Bustaman, Abd Manaf, and Abd Rahman (2020) found that the lack of video features led to students feeling isolated because they only interacted with texts and images during classes. Also, contrary to the present study's findings, Philipose and Rajagopal (2019) found that students were less active on the Google Classroom platform. The findings showed that not all the students interacted online with the lecturers and other students.

However, some literature also found Google Classroom an easy-to-use learning platform for students and lecturers. Shaharane et al. (2016) described the user interface as friendly and simple, allowing learners to navigate the platform with minimal effort and without frustration. The ease of use of the platform counted as a major factor that determined its adoption among students in Oman, according to Al-Marroof and Al-Emran (2018). The perceived usefulness of Google Classroom motivated students to incorporate it into their learning process. The Technology Acceptance Model (TAM) (Davis, 1985) gives an understanding of how users accept and use a particular technology. It identified attitudes, perceived usefulness (PU) and perceived ease of use (PEOU) as critical and influencing factors in determining the behaviour of users toward adopting technology. The findings of the current study are consistent with the TAM (Davis, 1985) in that the in-service teachers in the current study had a change in attitude towards ICT use and derived satisfaction from using Google Classroom (in comparison to the university's LMS) due to its ease of use and usefulness for learning activities. The social presence of the participants (Maddrell et al.,

2017) in the virtual environment also helped the in-service teachers to stay connected and develop stronger group cohesion.

- **Modelling of good ICT practice**

The current study found that the in-service teachers used ICT in their daily teaching practice as an unintentional outcome after studying at Horeb university. In this study, the in-service teachers' narrations revealed that lecturers effectively modelled using ICT tools for teaching. Hence, after their university experiences, the in-service teachers returned to their classrooms with practical skills and knowledge on how to integrate ICT into their classroom practice.

The extant literature abounds on how teacher training institutions do not adequately prepare teacher trainees to integrate technology into their classroom practice (Aslan & Zhu, 2016; Cuhadar, 2018; Tondeur et al., 2012) because educators fail to model the use of ICT tools while teaching. The previous empirical studies show the teacher trainees' inability to integrate ICT into their practice because educators at the teacher training institutions only taught "about ICT" rather than "teach with ICT". Aslan and Zhu (2016, found that teacher training programmes were ineffective in equipping pre-service teachers with the competencies required to integrate ICT into their practice. A study by Alemu (2015) revealed that teacher educators did not integrate ICT into their teaching despite the availability of ICT tools in the university.

5.6 Silences in the findings of the current study against that of extant literature

In this section, I present the silences in two ways. First, I highlight the empirical findings in the literature relevant to my study that was not evident in the findings of my study, hence the silences. Second, and more significantly, I reveal the study's findings that were not evident in the existing literature and thus contribute to the knowledge base. Therefore, I present these silences evident in the current study but not apparent in the literature as it is new knowledge grounded in this study. The two distinct types of silences are presented and discussed in the sections below.

5.6.1 *Silences in the current study*

First, the voluminous research suggests that teacher training institutions have not addressed pedagogical, content and technological knowledge (Koehler & Mishra, 2009; Koehler et al., 2013) as interrelated and interdependent concepts to prepare teachers effectively for ICT integration. However, the current study did not find any evidence to support this notion. The in-service teachers' learning experiences and subsequent classroom practice revealed that all three types of knowledge were purposefully integrated and addressed interdependently during learning at the university. This assisted the in-service teachers in achieving a more effective technology integration into teaching and learning.

Second, extant literature (Albion et al., 2015; Korthagen, 2017; Wambugu et al., 2019) found that professional development (PD) initiatives to integrate ICT are the responsibility of the administration or leadership of a school. However, the authors also could not explain the training effectiveness due to the inability of teachers to implement the knowledge and skills gained from such training experiences. This finding is silent in the current study as the focus was not on the effectiveness of school-based professional development initiatives on ICT integration.

Third, Alemu (2015) posited that the effectiveness of integrating ICT into teaching and learning is determined by the level of interaction between students and educators and between students and the technologies the instructors use. However, this was not evident as a finding in the present study.

5.6.2 *Silences in the extant literature*

In the following sections, I present three themes that are evident in my study: “mirroring good ICT practice”, “making a pedagogical shift” and “teacher resilience” as participants' experiences of living in “two worlds apart” as findings unique to my study. The “two worlds apart” portray the dual-lived experiences of the participants at Horeb university and in their resident schools of teaching.

- **Mirroring good ICT practice**

Significantly absent in the extant literature is the current study's finding that the in-service teachers mirrored the good ICT practices of their lecturers at the university when they

returned to their classrooms. The in-service teachers did not only replicate these experiences regarding how their lecturers modelled the use of ICT in their teaching but also exhibited an inherent desire to do so. They seemed impatient on their return to their classrooms to begin exploring and utilising their new-found ICT skills and knowledge acquired through observing the practices of their lecturers at Horeb. It must be emphasised that the in-service teachers enrolled at the university to improve their subject knowledge content, intending to stay abreast of curriculum changes. However, they returned to their schools with unintended experiences of ICT pedagogical knowledge and skills. The in-service teachers did not anticipate this significant learning outcome as they did not envisage the ICT-enriched learning experiences they encountered at Horeb university.

The in-service teachers enrolled at the university with the usual expectation of a repeated cycle of the chalk-and-talk teaching method. However, they found themselves in an unprecedented learning environment where teaching and learning demanded that they make constant use of ICT. Observing their lecturers teach with ICT required that they learn with ICT. Learning through ICT was a new and steep experience that changed their perspective towards teaching and learning as in-service teachers. The unique outcome of learning in an ICT-rich context provoked an act of purposeful, intellectually engaging, and appropriate incorporation of ICT into their teaching. The lecturers at Horeb modelled appropriate ways of purposefully weaving ICT into their lectures, and this motivated the in-service teachers to mirror the good practice through ICT-enabled teaching strategies.

McDonald, Kazemi, and Kavanagh (2013) identified modelling as one of the pedagogies that can support teacher learning. They argued that teacher educators could and did introduce different activities to pre-service teacher trainees through modelling. This modelled behaviour then encouraged the pre-service teachers to re-imagine how the ICT-integrated lecture activities could be replicated in their own classrooms.

Seemingly, the mirroring of good practice by the in-service teachers in this study also emerged vicariously. The relationship between social learning context and subsequent conduct or behaviour was clearly established in this study. According to Albert Bandura, social learning involves people learning from one another through observation and

imitation (Zhou & Brown, 2015). Bandura's theory implies that by watching other people's actions and their consequences, human beings are capable of absorbing information, skill, and attitude (Trif, 2015). Through observing lecturers' practice with ICT, the in-service teachers in this study realised the benefits of using ICT and were intrinsically motivated. The current study's participants reflected how they, as students, experienced increased levels of engagement through the ICT-enhanced teaching context. This, in turn, encouraged them to make deliberate efforts to mirror the same pedagogical experience in their classrooms to reconcile how they were taught at the university and at school. To re-iterate, the in-service teachers attended Horeb University to obtain further qualifications and become more subject-relevant; they returned to their schools with new ICT experiences and replicated their ICT observed learning experiences in their own classroom practice. This finding is not evident in the voluminous existing literature and is unique to the present study.

Previous empirical studies have shown that modelling the use of ICT to teacher trainees by lecturers in higher education teacher training institutions is lacking (Aslan & Zhu, 2016; Mukuna, 2013). A synthesis of several qualitative studies by Tondeur et al. (2012) identified five key themes as strategies for preparing pre-service teachers to use ICT in the classroom. One of the strategies included teacher educators acting as role models for pre-service teachers. Tondeur et al. (2012) found that there was a lack of adequate modelling of ICT use by teacher educators in teacher training institutions. Teacher educators did not model the pedagogical use of ICT to teacher trainees. Hence, it was difficult for the teacher trainees to assimilate or mirror the same in their classroom practice. Similarly, Cuhadar (2018) found that teacher trainees did not perceive teacher educators as role models, particularly in supporting good classroom practice.

Mukuna (2013) also suggests that preparing a generation of teachers who would be capable of effectively integrating technology into their teaching and learning may remain a dream if there are no teacher training educators to model the use of technology in their own lectures adequately. The author found that the revolution of modelling new teaching tools, namely, information and communication and pedagogy, should be the domain of teacher training institutions. However, the Mukuna (2013) study also pointed out the fact

that technology adoption does not occur automatically but rather in stages; hence only teacher educators who have reached the “innovator” or “initiator” stage can adequately model the use of ICT to teacher trainees.

Mbalamula (2016) found that lecturers’ use of ICT for teaching influenced the student-teachers’ decision to use ICT for learning. The author argued that teaching involves the creation of a suitable learning environment that facilitates learners to develop skills and knowledge about a certain phenomenon; hence, learning occurs because of the experiences within such an environment. The study posited a need to integrate the TAM model (Davis, 1985) into a broader model to accommodate human and social change processes, considering technology acceptance as a psychosocial process involving relative modelling of learning experiences within the classroom.

Evidently, appropriate learning experiences play a significant role in acquiring skills, knowledge, or competence for teaching at all levels. In the current study, lecturers as role models significantly added value to the in-service teachers’ ICT pedagogical practice. It is important to note that the current study's findings contrast with the principles of the theory of ‘apprenticeship of observation’, which claims that teacher trainees enter teacher education programmes with pre-conceived notions of what teaching is or should be (Lortie, 1975). Thereby student teachers form indelible perspectives about teaching underpinned by their own previous experiences of observing teachers teach. According to the apprenticeship of observation theory, student teachers tend to teach how they were taught, based on the experiences garnered from observing teachers’ practice from their primary and secondary school days. This weakens teacher education's effect on teacher trainees' practice (Smagorinsky & Barnes, 2014). However, the participants in the present study, expecting a familiar traditional approach to teaching by the lecturers at Horeb university, were exposed to technology-integrated teaching practice.

Lortie’s (1975) “apprenticeship of observation” argues that teachers enter teacher education programmes with assumptions about how schools should be or look. Gray (2020) and Smagorinsky and Barnes (2014) concur with the findings of the current study and found Lortie’s theory to be problematic as this study’s findings reveal that with the

exposure of teachers to a wide range of ICT resources, tools, and professional development opportunities, they can rethink their practice. In the current study, the in-service teachers re-envisioned constructivist teaching approaches in their own practice and questioned the teaching methods they observed or were taught. This re-envisioning entailed the in-service teachers revisiting their previous teaching methods as archaic.

In alignment with these findings, the evidence of the current study illustrates that the in-service teachers did not want to teach the way they were taught in their primary, and secondary education. They perceived those teaching methods to be boring, monotonous, and traditional. The experienced in-service teachers in this study could shift from the traditional teaching methods they were used to and employ more engaging, learner-centred, and ICT-enabled teaching methods. This study found that in-service teachers adopted a new perspective on their pedagogical knowledge. Hence, they viewed knowledge not just as a set of facts but developed the ability to unlearn (traditional teaching experiences), learn (through modelling) and relearn (through mirroring) regarding their classroom pedagogical practice. The knowledge acquired through interaction with ICT tools by accessing new and relevant information on subject content and pedagogic approaches was put into immediate practice in their class.

The participants in the current study, whilst studying through ICT and coupled with vicarious observation of lecturers' ICT-integrated practices, acted as a catalyst for changing their classroom practice. Therefore, the participants' learning experiences at Horeb university played a significant role in interrupting the “unhealthy” cycle of teaching the way they were taught in their schooling and initial teacher preparation years. The participant in-service teachers gained new subject knowledge and were empowered with new ICT pedagogy skills and personal learning experiences. The in-service teachers in the current study adopted new constructivist and ICT-enabled teaching strategies that further enhanced engagement, concentration, collaboration, and autonomy in their practice. This empowerment initiated the beginning of an ICT-pedagogical shift among the in-service teachers.

- **Making an ICT pedagogical shift**

In the current study, the in-service teachers acquired content knowledge and technological pedagogical knowledge through their learning experiences at Horeb university (vicariously). Though both occurred concurrently, the technological pedagogical knowledge was not an intended outcome for the in-service teachers or Horeb lecturers. This unintended outcome prompted a pedagogical shift that became evident in their practice after returning to the schools where they were employed. Technological pedagogical knowledge (TPK) cannot be isolated from content knowledge (CK) and general pedagogical knowledge (PK) due to the interdependent nature of these types of knowledge in integrating technology into teaching and learning. Research posit that content knowledge and the pedagogical competence of teachers are significantly connected to technological capabilities; hence the three need to be well-aligned to facilitate effective use in classroom practice (Voogt et al., 2013). Technological knowledge (TK), when combined with the availability of the appropriate type of ICT tools in the classroom, influences the choice of teaching and learning (pedagogy) activities designed and implemented by the teacher (Chandra & Mills, 2015; Ertmer & Ottenbreit-Leftwich, 2013; Koehler, Mishra, & Cain, 2013). Therefore, developing proper pedagogical knowledge and its appropriate application to ICT is considered as crucial as the technical ability to use ICT.

In the previous chapter, I reported the narratives of in-service teachers on their ICT experiences, which spanned their activities as students and teachers. According to Koehler and Mishra (2009), teaching is a complex practice which demands the use of a combined set of specialised knowledge to achieve effectiveness. Practising in socially, culturally, and technologically different classroom contexts requires teachers to continually shift their pedagogical understanding and perspectives to cope with the dynamics resulting from changes brought about by technology. In the current study, a noticeable shift in the pedagogical practice of the in-service teachers occurred in their classrooms because of their learning experiences with ICT during their tenure as students at Horeb University. This experience significantly influenced their choices of ICT tools, strategies and learning activities in their teaching repertoire. Their experiences using ICT for learning as students translated into the exploration of new and more engaging teaching methods that placed the

learner at the core of all planned classroom activities, thereby shifting away from their previous traditional (chalk and talk) teaching approaches. Through different teaching methods such as inquiry, collaboration and guided discovery, the in-service teachers transformed their teaching by engaging in classroom activities that allowed interaction with ICT. To re-iterate, the in-service teachers in this study enrolled at the university to further their subject knowledge and obtain a higher qualification; however, they were enriched pedagogically through their ICT learning experiences.

There is a dearth of literature that explains the above phenomenon. However, research evidence describes teachers as resistant to technological and pedagogical change regarding the integration of ICT into their classroom practice (Amuko et al., 2015; Sánchez-Prieto et al., 2019; Vrasidas et al., 2010). The current study's findings revealed that in-service teachers seemed to have a changed perspective on the importance of making a shift pedagogically. In-service teachers were prepared to embrace change and were quite enthusiastic about keeping themselves abreast of the dynamic teaching and learning landscape to meet their learners' expectations and deliver the curriculum effectively. Constant changing policies and dynamic curricula contributed to the need for the participants in this study to seek a means of remaining updated and staying ahead of the curve. Their quest and thirst for self-development and personal advancement also justify the motivation to implement change in their practice.

Drawing from the current study's findings, before their studies at the university, the in-service teachers possessed a vague knowledge of the use of ICT in their practice. Seemingly they depended solely on their Technology Knowledge (TK), some of them using ICT mostly for administrative daily attendances, and termly reports. Prior to their Horeb experiences, participants in this study did not integrate ICT into their classroom instruction for learning. After their learning experiences at Horeb university, which involved vicariously observing their lecturers' ICT practice, they seemed to develop technological pedagogical knowledge (TPK) which helped them with a deeper understanding of how to add a pedagogical strategy to augment the use of technology for classroom instruction. After their learning experiences at Horeb, the in-service teachers returned to their classrooms to utilise their new technological pedagogical knowledge for

integrating ICT into instruction. Daily practice helped them develop and appropriately use the combined knowledge needed for effective ICT integration into classroom instruction. The in-service teachers could define expected learning outcomes, select the appropriate teaching pedagogy, and then identify and use the appropriate types of technology that supported the chosen activities to aid effective learning. The in-service teachers effectively combined these sets of knowledge types, as posited by Koehler and Mishra (2009), to change their classroom instruction to create a better learning environment for their learners.

- **Teacher resilience: Two worlds apart**

In pursuit of the theme “two worlds apart”, the two lived contexts of the participants in this study revealed distinct contrast in areas such as access to ICT tools, institutional ICT policy, and rules and regulations. The two different contexts provided different experiences for the in-service teachers. First, in contrast to Horeb University, that was well-equipped with ICT tools to adequately support student learning, the schools where the in-service teachers taught lacked adequate ICT tools. Hence, utilisation of the participants’ newly acquired ICT skills and knowledge to teach became a huge challenge. Second, Horeb university promoted a policy that provided a clear and seamless approach to ICT integration into teaching and learning. In contrast, the schools where the in-service teachers practiced had no policy, written or verbally communicated, to support ICT integration. The policies guiding the use of ICT at Horeb university were supportive and unrestrictive compared to the very constrained school contexts. However, despite all the school conditions, the in-service teachers steadfastly sustained ICT pedagogical change in their practice. The current study's findings revealed that the in-service teachers were resilient to change their ICT pedagogical practice.

The extant literature, however, seems to be silent on teacher resilience in the face of adversity to pursue ICT initiatives to ensure the integration of ICT into their practice. Many research studies (Al Mulhim, 2014; Opeyemi et al., 2019; Zakaria & Khalid, 2016), especially in developing countries’ context, report on the unavailability of ICT tools and how this inhibits teachers’ practice. Some literature (Makki et al., 2018) is also evident on other contextual factors that hinder the use of ICT for teaching and learning. Significantly, in contrast to the current study, Ertmer (1999) found that teachers, when confronted with

these external factors, often “give up” and resume traditional classroom practices (Vandeyar, 2013). The extant literature also suggests that teachers confronted with ICT constraints or challenges often gradually accepted the prevailing conditions surrounding them and resorted to using available traditional tools for teaching and learning, acting as bricoleurs (Batchelor et al., 2012). In this study, the teacher as “bricoleur” refers to a person who improvises with existing resources and constraints to teach, the teacher “makes do” with what is available.

However, the in-service teachers in this study, rather than present themselves as bricoleurs, became innovative users of ICT in their classroom practice to ensure that their changed practice was sustained. The in-service teachers did not “make do” with existing resources but opted for alternative means of sourcing ICT tools for use during teaching and learning. Notwithstanding the significant challenges the in-service teachers encountered in the school context, which made the integration of ICT into their everyday classroom practice very difficult, the participants found innovative means to enhance their teaching with ICT. In this study, the in-service teachers allowed their students to bring personal devices to the school to mitigate the problems of shortage of ICT tools among learners. This initiative was taken personally, and approval was sought from the school administration to allow students to bring their devices.

The in-service teachers in this study sought different ways to make ICT integration possible, even in their resource-constrained school contexts. First, despite the usual busy schedule that characterised daily school activities, the in-service teachers in this study took advantage of the “free periods” on the school timetable. During these periods, when learners were free from other academic activities within the school, arrangements were made to visit the school ICT laboratories, where they accessed the available ICT tools for self-learning. One participant, Adeline, reported that her learners’ self-confidence increased daily as they interacted more with the OLPC laptops. Observably enhanced ICT skills were developed as learners became more independent in using the computers for learning.

Second, to mitigate the challenge of the lack of access to ICT tools, especially computers, the in-service teachers allowed the learners to bring their own devices (BYOD) to school.

ICT devices such as iPad, laptops and tablets were used by learners to participate actively in classroom activities that involved the use of ICT. This was not an easy option as it meant that teachers were personally responsible for the ICT devices in the case of damage or theft. This was a huge responsibility for the in-service teachers to assume, considering the financial burden imposed in the event of learners' ICT devices being damaged or stolen. Despite this, many of them were willing to take this added responsibility just to ensure that no learner is left behind in developing required ICT skills and competence. This teacher resilience was evident to ensure that learning in their classroom was sustained with engaging and interesting activities to achieve deep learning through ICT.

Third, in the absence of school-level policies on integrating ICT into teaching and learning, the in-service teachers, based on their experiences at Horeb university, adopted similar patterns of integrating ICT into their practice. In other words, although the in-service teachers were employed in different schools, their strategies for classroom practice with ICT were similar. Classroom observation revealed that activities such as lesson planning, delivery, learning activities and evaluation of lessons involved using ICT. Ideally, school-level ICT policy plans describe the goals, expectations, and actions to ensure ICT's effective integration into education (Vanderlinde et al., 2012). Despite the absence of appropriate ICT integration policies and guidelines, the in-service teachers pursued ICT integration. They ensured that the choice of ICT tools and learning activities were appropriately aligned with the specific content to be taught and the pre-determined lesson objectives to be achieved.

Furthermore, despite the schools' constraining and restrictive rules and regulations regarding the use of ICT for teaching and learning, the in-service teachers practiced ICT integration. The rules and regulations, some of which included prohibiting teachers from taking laptops home for lesson plan preparation, made the ICT integration arduous for the in-service teachers. Additionally, some schools disallowed the use of the ICT laboratories without the permission of the designated teacher in charge of the laboratories; hence the absence of approval hindered access to the ICT tools for learning. ICT tools were prohibited from being taken out of the ICT laboratories, even for use within the school; hence teaching that required technology tools presented additional challenges for the in-

service teachers. Notwithstanding the restrictive rules and regulations regarding using ICT for teaching and learning, the in-service teachers tried to ensure that ICT tools were available for teaching and learning.

5.7 Theorising the findings

5.7.1 *Activity theory as a theoretical framework*

This study explored the ICT learning experiences of the participant in-service teachers (students at a HEI Horeb University in Rwanda) and their influence on their classroom practices. The current study attempted to explore and understand how the participants' ICT-mediated learning experiences influenced their classroom practice in their various school contexts. I tried to understand how their interaction with ICT tools in a technology-enabled learning environment may influence their pedagogical practice. To this end, this study was underpinned by Vygotsky's Activity Theory (AT) as expanded upon by Engeström (2001). The choice of this theoretical framework allowed for a holistic and systematic understanding of the phenomenon under study. Research evidence suggests that ICT integration at any level of education is a complicated process. Hence, ICT cannot be isolated or studied as "*the influencing factor*", but rather "*an influencing factor*". Activity Theory and its component elements are suitable to capture all the contributing factors that interplay in how in-service teachers' learning through ICT may or may not influence their teaching practice. In the current study, Activity Theory focuses on what happens between human beings as actors in a social context and technology tools as they pursue collective activities while learning (Sannino & Engeström, 2018).

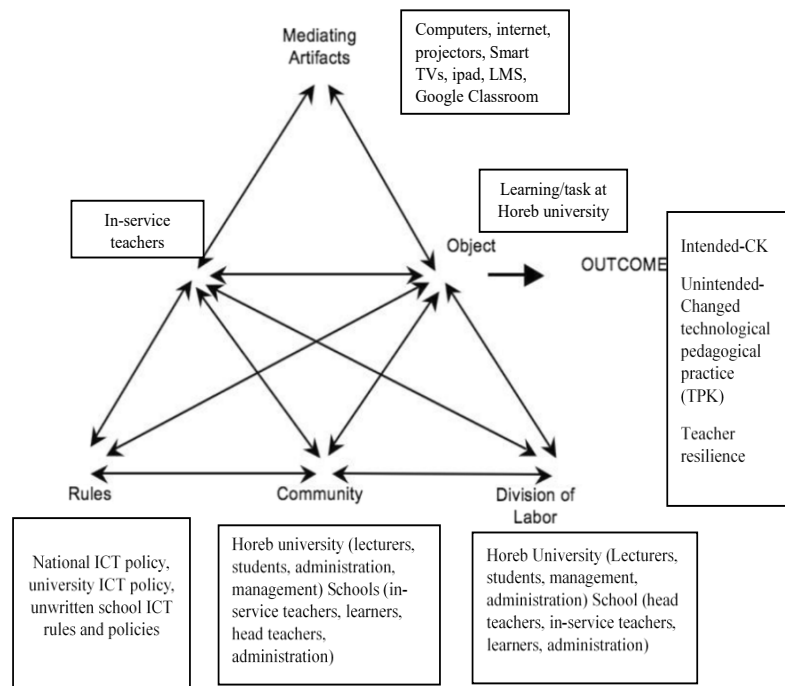
In this study, the unit of analysis or the subject of inquiry was principally the in-service teachers. They consisted of in-service teachers enrolled at the university to further their studies, obtain a professional higher education degree, and become more appropriately qualified. According to Activity Theory, the interaction between the subject (in-service teachers), the learning tools (ICT) and how this interaction could lead to a changed practice represents the outcome. The "rules" were governed by two distinct contexts: school and university. In Activity Theory, the rules are determined by the policies and rules in both contexts. The AT tenet of "division of labour" is represented by the different stakeholders,

namely, school administrators, lecturers at the HEI, in-service teachers and education authorities within the Rwandan education sector.

The effective use of technology is an intricate process that requires time, equipment, institutional support (Ertmer, 1999), positive attitudes (Liu, 2006; Zhao, 2005) and teachers as change agents. The pedagogical use of ICT in schools is a rather complex process involving principally teachers at the edge where policy (rules) meets practice (outcome). This complexity is the underpinning reason why this study examined in-service teachers' learning experiences and their practice through the lens of Activity Theory. Vygotsky's original version of the AT triangle was constructed to reveal the relationship between subject and object and how they are mediated through tools. However, this was modified and expanded upon by Engeström and then renamed Cultural Historical Activity Theory (CHAT). Engeström introduced two other units of analysis that may affect the activity being performed.

Figure 5.1

Second Generation CHAT



(Engeström, 1987)

The complex relationship and interplay between the rules and regulations, community and division of labour depict a more complicated mediation of social action (Nyoni, 2013). I interrogate each of the tenets of the AT in light of the findings of the current study.

- **Activity Theory tenet: *Subject***

The group of people or persons whose perspective the analysis is focused on is the subject of an activity system (Wilson, 2014). The in-service teacher participants represent the *subjects* in this study. In-service teachers are characterised as unqualified or underqualified teachers already in employment in the education sector who desire to further their education to obtain the required qualification according to the standards in Rwanda. According to the standards set by the Ministry of Education in Rwanda, the least qualification for practicing teachers is a bachelor's degree in education. The participants in this study were enrolled in the university to obtain this qualification to satisfy the minimum requirement to qualify as teachers. Before enrolling at the university, the in-service teachers' qualifications ranged from Teacher Training College (TTC) to Senior Six (senior secondary school) certificates.

This study revealed that teachers, particularly those already in the education system (in-service) working in the schools, must be constantly conscious of their roles and significance, thereby maintaining the expected level of relevance as they discharge their duties within the school. The participants in this study understood the expectations placed on them by the constant changes in society to produce learners that would seamlessly fit into the 21st century workplace. They acknowledged that the teaching and learning landscape has evolved, and therefore, teacher and learner expectations have changed regarding learning outcomes. The in-service teachers in the current study seemed discontented with many things relating to their practice, including knowledge of subject matter and methods of curriculum delivery. Thus, improving and aligning their subject practice with 21st century curricula expectations became inevitable, and hence the focus on in-service teachers. The dissatisfaction with the status quo, in other words the perception that teachers are the sole custodian of knowledge (Agyei & Voogt, 2014) fuelled the aim of the in-service teachers to equip themselves with the required skills to create a

collaborative, engaging and stimulating learning environment where learners are accepted as co-creators of knowledge.

Teachers have and should always be at the centre of any innovation in education; without them, no significant systemic change can be achieved. Government policies, education reforms and mechanisms for change in education would remain documents without a chance of effective and successful implementation without a changed mindset and the active participation of teachers.

- **Activity Theory tenet: *Object***

The *object* as a tenet in the Activity Theory model is the ICT-mediated learning experiences of the in-service teachers. Olson (2015) posits that learning is a permanent change in behaviour due to acquired experience. Learning is a broad construct that has been viewed from different perspectives by researchers and given interpretations according to context. In this study, learning for the in-service teachers meant taking deliberate steps to acquire content knowledge and delivery skills that would enhance their classroom practice and place them in a position of professional relevance and acceptance. Undertaking cognitively or mentally tasking activities in the process of studying was part of their expectations as they embarked on the journey of learning. Learning theories explain the processes humans engage in to make meaning of information and how they integrate that information into their mental models to accommodate the new knowledge. Daudi and Yvette narrated that it was more convenient for them to search for further information on any newly introduced concepts and confirm their authenticity and relevance to previous knowledge. Research established that using ICT tools fosters constructivist learning approaches and styles (Bahufite, 2015; Orlando, 2013). Mastering the art of deep searching the internet for relevant information is a valuable skill for students as it enables students to examine different perspectives on the same topic (Utecht & Keller, 2019).

- **Activity Theory tenet: *Tools***

According to activity theory, the tools are the materials, objects, or artefacts used to accomplish an outcome activity. In the current study, tools were used by the in-service teachers in two different contexts, firstly, tools for learning in an ICT-enriched HEI

environment and secondly, for teaching at the schools where in-service teachers were employed.

- **Tools for learning at Horeb University**

In this study, the in-service teachers' learning was mediated through ICT tools like computers (desktop and laptops), tablets, mobile phones, learning management systems, the internet, and appropriate software (including social media and multimedia projectors). These ICT tools served various purposes during face-to-face lecture sessions and virtual learning spaces. The computers (desktops, laptops, and smartphones) were the principal ICT tool that facilitated the use of other tools and resources like multimedia projectors or smart televisions, the internet, software and applications. In this study, not all the participants possessed personal ICT tools for learning. However, the in-service teachers, as students, had access to various ICT tools for learning. The desktop computers were accessed at the university's ICT laboratories for completing assignment tasks, while the laptops were used at other locations, including homes, because of their portability.

Reading materials, and assignments in various formats such as Microsoft Word, PowerPoint, and Portable Document Format (PDFs), were created and stored in the computers by the in-service teachers. At Horeb university, learning with ICT tools was imperative, hence the need for the in-service teachers to develop and master the required skills for using them. Computers were used to mediate learning by accessing material such as images, videos, and diagrams on the internet. The materials and resources were then presented to facilitate engagement and make learning activities more meaningful. Students enjoyed stable internet connectivity, allowing them to seek information beyond the boundaries of their lecture rooms, region, and country.

Smart televisions in the lecture rooms and the ICT laboratories aided the learning of the in-service teachers and helped with the visualisation of subject content. Face-to-face lectures were more engaging when lecturers displayed PowerPoint presentations on the smart televisions. The participants in this study sometimes found the displayed content to be more explanatory than the verbal input of the lecturer. Furthermore, the audio, videos or images that accompanied the notes captured their attention and made it quite effortless to concentrate on learning and interpret concepts based on individual experience. The in-

service teachers narrated that learning was not restricted to verbal explanations from the lecturer alone. Deeper meaning and knowledge construction were achieved by interacting with other forms of learning material with which they interacted through other senses.

Internet-enabled devices, particularly computers, helped the in-service teachers to engage in a further self-directed search for additional learning resources and material such as journal articles and e-books. Furthermore, students accessed different websites, such as NASA, and used the general Google search engine results for learning. According to Daudi, relying only on the contents provided by the lecturers during the face-to-face lecture sessions left him unsatisfied as a student. Hence, he sought additional and more subject-relevant information and content by accessing different websites for material that could establish entrepreneurship concepts in a more detailed manner. He also had the opportunity to compare the business and entrepreneurship climates of different countries within and outside East Africa.

The participants in this study found video technology such as YouTube as a useful resource in their daily activities as teachers and learners. YouTube is a platform that provides free access to various videos useful for different purposes, including learning. Some of the factors that endeared students to the use of YouTube for learning included accessibility (Jaffar, 2012) and perceived learner engagement. Roodt and Peier (2013) posited that YouTube affects learner engagement positively and has the potential to cater for different learning styles among higher education students. The study also confirmed that students searched and watched course-related videos to support learning. The video narrations and picture animations captured the students' interest, thereby increasing their ability to retain and recall information received during the learning process (Almobarraz, 2018). The participants in this study were more likely to attend lectures where ICT was employed as they felt it enhanced meaningful learning engagement. They were reluctant to attend lectures that were devoid of ICT use.

- **Tools for teaching in the schools**

Similarly, ICT tools were used to mediate teaching activities when the in-service teachers returned to their schools after every semester. The potential of computers, the internet, email, YouTube, and multimedia projectors were harnessed to enhance learning activities

in the classroom. Employing ICT tools seemed to have simplified the work of the in-service teachers and allowed them to use time efficiently. The in-service teachers narrated that YouTube videos effectively taught concepts through demonstration and observation. Teachers felt that learners grasped concepts faster and better using the video medium. ICT tools' role in the classroom has been established as it has brought various innovations into the teaching and learning process at different levels of education.

The choice and purpose of tools used for teaching reflected the possession of adequate knowledge of the appropriateness of such tools to the content and the pedagogical strategies employed. The in-service teachers demonstrated the ability to select ICT tools that aided the teaching of subject content in a manner that facilitated participation, collaboration and engagement among the learners in the classroom. ICT tools like computers connected to multimedia projectors were used in the presentation of PowerPoint slides to explain subject content during teaching. Similarly, internet-enabled iPads were used to access and store information relating to certain topics in different subjects. Communication with parents, school administration and the learners became more efficient through emails and other collaborative platforms like Google Classroom and WhatsApp (social media).

- **Activity Theory tenet: *Outcome***

The *outcome* represents the research question and focus of the study, namely, whether the in-service teachers' experiences through learning in an ICT-enriched environment would influence their pedagogical practice. The in-service teachers' narratives revealed dissatisfaction with their previous practice concerning how they taught in their daily classroom activities. There was a sense of inadequacy, and they felt a gap existed in their content knowledge and skills. In the current study, the AT outcomes are categorised as intended and unintended outcomes.

The intended outcome was the expectation of the in-service teachers to improve their content knowledge (CK) and delivery skills, which they believed would position them better in their practice. This is characterised by presenting enriched and authentic information to learners in different subject areas. The narratives of the in-service teachers revealed that in preparation for teaching, they consulted different sources of information to consolidate and validate facts before presenting them to learners in their class. Improved

mastery of subject matter helped them to “own” the lesson and increased their self-confidence. Furthermore, the in-service teachers developed improved presentation skills, which allowed information to be presented to their learners in a well analysed, synthesised, and summarised method, without ambiguities and confusion.

The first unintended AT outcome is characterised by a shift in the ICT pedagogical practices of the in-service teachers as a direct consequence of learning with technology coupled with vicarious mirroring of observed good teaching practices of their lecturers. Although an ICT pedagogical shift was not included in the initial expectations as a possible outcome of studying at the university, the in-service teachers found themselves making an ICT pedagogical shift. It is evident in the current study that while the in-service teachers pursued content knowledge (CK) they gained technological pedagogical knowledge (TPK), which was an unintended outcome of their learning activities.

The second significant unintended outcome that was not evident at the onset of the study was the in-service teachers’ resilience and perseverance to use ICT under constrained contextual conditions at schools. The apparent change in the ICT pedagogical practices of the in-service teachers resulted in resilience among the in-service teachers. The strong desire to sustain the newly acquired practices spurred resilience in constraining environments. This unintended outcome significantly contributes to the activity theory model, as an indication that not all outcomes may be apparent at the time of framing the theoretical framework to scaffold this study. Despite being guided by a theory in the course of carrying out a study, openness to unintended outcomes that may significantly affect the study results should be of utmost importance to researchers using AT.

- **Activity Theory tenet: Rules and regulations**

In this study, the relationship between the subject (in-service teachers) and the community (the university environment and the schools) was mediated by certain rules and regulations portrayed as “two worlds apart”.

First was the participants’ experience at the university. Horeb university had rules and regulations that were clearly spelt out in the ICT policy documents, including those guiding academic and administrative activities. These rules were evident to establish a strong network of support for students and lecturers to achieve the desired goals of an ICT-

supported learning environment. Lecturers were expected to integrate ICT into their lecture sessions, either face-to-face or virtual. This requirement justified the presence of Smart televisions and projectors in the lecture rooms. Furthermore, Horeb university had structures in place to ensure student and staff compliance by channelling all activities through the Management Information System (MIS) set up with ICT. Routine processes such as course registration, fee payment, generating examination cards, and checking of results for completed semesters were done through the individual student portals, accessed on the Management Information Systems of the university. Additionally, assignment submissions and grading were done through Google Classroom, and all students were expected to comply to avoid loss of marks for any course or semester.

The second was the experience within the school context. The situation at the schools, however, seemed different as the rules and regulations were restrictive and unsupportive of the use of ICT. In schools, it was difficult to access the ICT laboratories and the tools available there, such as computers, the internet and multimedia projectors, because the laboratories were locked up for security purposes. As an inferred rule, the burden and responsible use of ICT tools resided with the teacher in the event the ICT tools were damaged or misplaced during lesson presentation. This personal responsibility for technology tools negatively influenced the in-service teachers' motivation to use ICT for teaching and learning in their classrooms. Most schools in this study had only one ICT laboratory serving all the teachers; hence scheduled use of the ICT laboratories for access became necessary. Despite these difficulties, the in-service teachers remained resilient and committed to integrating ICT into their daily practice.

- **Activity Theory tenet: *Community***

In this study, the “two worlds apart” was also evident in the communities represented, two distinct contexts, namely Horeb university and the different schools where the in-service teachers were employed. Horeb university is a higher learning community comprised of lecturers, ICT support staff, students, administrators, and management. At the same time, teachers, head teachers, learners, and administrators constituted the members of the school community. It seemed that members of the university community were supportive of the in-service teachers' endeavour as students.

The lecturers employed ICT for teaching, which significantly influenced the in-service teachers' perspective on what effective teaching and learning should be, and the approaches to achieving teaching goals. Different courses cutting across various aspects, including sciences and arts, were presented with ICT tools and resources, facilitating students' constant interaction with ICT while learning.

The in-service teachers in this study narrated that being in the midst of other students with varying ICT skills helped them benefit from a community of peer learners. Peer learning was inevitable in a learning environment like that of Horeb university, as lecturers encouraged collaborative learning methods through joint classroom presentations, group assignments, and online learning platforms like Google Classroom. This collaboration created several opportunities for the in-service teachers to glean enough information and skills from one another's experiences regarding ICT use for learning. While Horeb university seemed to be a supportive community for the in-service teachers, the school communities where the in-service teachers were employed seemed less conducive and discouraging for the practice of the in-service teachers. Koehler and Mishra (2009) posited that institutional contexts often oppose teachers' efforts to integrate technology into their practice.

The school community included teachers, learners, parents, head teachers and other members of the administration, such as the Director of school, Head of studies and others, this varied according to the size of the school.

Teachers in the school communities possessed limited awareness and knowledge of the inherent values in using ICT for teaching and learning. The number of teachers integrating ICT into their daily practice was low; hence, sharing professional ideas and input with colleagues on ICT pedagogical practice was difficult. Interestingly, however, after the practice of the in-service teachers was observed by other teachers on returning to their schools, some of the teachers approached them to seek guidance on how they can also integrate ICT into their lessons, thereby forming some similitude of communities of practice.

- **Activity Theory tenet: *Division of labour***

Activity theory defines the division of labour as a component that refers to “who does what” with reference to the object (learning) within the Horeb university context and outcome (pedagogical practice) in the school context. In the current study, the division of labour is determined mainly by areas related to teaching and learning, policies, and professional development by the various stakeholders concerned. Within an activity system, the failure of any of the stakeholders to do their part directly or indirectly inhibits the optimum performance of the system. This, in turn, determines the effectiveness or otherwise of the activity system. Therefore, the system's interdependent nature calls for effective collaboration, cooperation, and synergy among the elements to guarantee optimum performance. In the current study, at Horeb university, labour was divided among the in-service teachers as students, the lecturers, and the administration and management of the university. Division of labour was well-defined, and each stakeholder accepted responsibility as expected.

Horeb university, as a higher learning institution, also played a part that imparted significantly on the outcome of the activity performed within the system. The university provided an ICT-enriched learning environment conducive to effective teaching and learning. Facilities were available for use by both lecturers and students to ensure that teaching and learning goals were easily achieved. Both students and lecturers received adequate support to thrive in an academic environment where communication, collaboration, and engagement were prioritised and encouraged. Horeb university management and administration played a significant role in creating a supportive environment for the in-service teachers as students. The management invested in modern ICT tools and resources to ensure that students learn in an ICT-enriched environment. Furthermore, the management provided clearly defined and formulated ICT institutional guidelines and policies that directed the actions of all stakeholders within the university. This helped the community members to perform as expected and take up designated responsibilities.

The different school contexts, however, presented a picture of ambiguity in the division of labour in ensuring the integration of ICT into teaching and learning. In terms of division

of labour, the schools were constituted of learners, teachers, head teachers and other external stakeholders such as the ministry of education. Formulation of relevant ICT policies and the further breakdown of such policies at the district and school levels for effective implementation as expected are the responsibilities of specific stakeholders in education. They include the Ministry of Education (MINEDUC), Rwanda Education Board (REB), District Education Offices (DEO) and head teachers of schools. However, it seems that the only available ICT policy was that of the ministry of education, which was not devolved to and in the schools.

In conclusion, this study found that all the elements of the activity theory had an interrelated effect on the outcome. The motive for the subjects' (in-service teachers) engagement in the activity was the object (learning) to achieve an intended outcome, which was improved content knowledge (CK) and curriculum delivery. Still, in the end, they also achieved additional unintended outcomes: technological pedagogical knowledge (TPK) and teacher resilience. The framework's foundational concept, the "activity", is understood as purposeful and transformative in nature. Hence the transformation in the classroom practice of the in-service teachers is evident in this study.

Several studies in the field of education have found AT quite useful and effective in explaining phenomena related to learning with ICT (Bligh & Flood, 2017). The AT views human interaction as mediated by tools within particular contexts. Activity theory has been used to collect, analyse, and interpret data on the transformation of collective practice within different contexts. This study indicates that the interplay among the elements of an activity system is important to understand the outcomes of an empirical study. In the current study, the ICT experiences of the subjects (in-service teachers) were mediated by ICT tools and artefacts at Horeb university which changed their perspectives about the pedagogical affordances of ICT for teaching and learning in their practice. The combination of the community, rules and regulations and division of labour as elements of the AT also significantly impacted the practice of the in-service teachers within the school context (Wilson, 2014).

5.7.2 *Reflecting on other relevant theories*

In this section, I want to reflect on appropriate theories in the field of ICT that are relevant to the research focus of this study. The study's findings are also interrogated against other theories to strengthen the arguments and support my stance as a researcher in the phenomenon under study.

The Technology Acceptance Model (TAM), espoused by Davis (1989), can be used to measure the factors that affect the acceptance of technology by its users. The acceptance and use of ICT for learning at Horeb university students also hinged on the tenets of the TAM theory. According to the theory, the use of any technology regardless of the purpose, has an increased likelihood if the user perceives it to be easy to use or is useful for a particular purpose that adds value to the user. Three elements of the TAM model stirred a change in behaviour towards using ICT amongst the in-service teachers. These elements include perceived ease of use (PEOU), perceived usefulness (PU) and user's attitude. Overcoming the fear and anxiety of technology and experiencing the differences between ICT and non-ICT-enabled lecture sessions paved the way for the change in perception about the ease of use and usefulness of ICT tools. Thus, a changed attitude towards ICT, perceived ease of use and perceived usefulness changed the in-service teachers' perception about ICT tools and resources for teaching and learning, resulting in a changed practice.

According to Lortie's (1975) theory, the apprenticeship of observation helped strengthen the argument that teachers do re-learn by observation. The theory postulated that teacher trainees enter training colleges with a mental picture of what teaching should be based on past observed experiences of teachers in practice, especially from primary and secondary school education years as learners. Through years of vicarious observation of teachers' practice during their formative years, pre-service teachers have pre-conceived notions about what teaching is about, as they see teaching at the coalface of its practice and not teaching as a complex science (Vandeyar, 2020) However, this study revealed that in-service teachers rather unlearned the methods and techniques they were exposed to from previous experiences and relearned new and more effective strategies of pedagogical practice employed by lecturers at the university. This study demonstrates that previously formed perceptions and experiences can be changed.

The Technology Pedagogy and Content Knowledge (TPACK) framework emphasises the overlap among three types of knowledge bases, a combination of which produces different intersections that facilitate the effective integration of ICT into teaching and learning. The three basic types of knowledge include content knowledge, pedagogical knowledge and technological knowledge. The framework, as espoused by Koehler & Mishra,(2009), assists teachers with comprehensive information on the significant overlap among the knowledge components of the framework and how they affect the integration of ICT into classroom practice. In this current study, the overlap among content knowledge, pedagogical knowledge and technological knowledge created an intersection of technological pedagogical knowledge and content knowledge, which underpinned the transformation in the classroom practice of the in-service teachers. In the current study, the application of technological pedagogical knowledge (TPK) played out in the return of the in-service teachers to their classrooms. They chose appropriate ICT tools to interpret and represent content or subject matter which facilitated a more meaningful and concrete teaching and learning process and resulted in the faster achievement of learning goals.

Bandura's theory of social learning emphasises learning as an interrelationship between cognition and the environment (Bandura, 1962). Hence, learning is influenced by the occurrences in the environment. In other words, learning occurs because of social interaction. According to Reed et al. (2010), to consider a learning process as social, the process must meet certain criteria, which include evidence of change in the mastery and perception of individuals and evidence that change transcends the individual and is located within a wider community of practice. Furthermore, the process must have occurred through social interaction. The experiences and narration of the in-service teachers in the current study met all the conditions stated above, hence the relevance of the social learning theory to the current study. Through social interaction, the participants in the current study learnt from their peers and lecturers.

Finally, the in-service teachers in the current study, after their learning experiences at Horeb university, portrayed themselves as planners, not as bricoleurs (Pina e Cunha, 2005) through their actions and personal initiatives within the school context. Prior to their experiences at Horeb university, the in-service teachers, being bricoleurs, were satisfied

with working with only the available tools and traditional strategies for teaching. However, after their return from the university, the in-service teachers sought to use better and more appropriate tools for teaching and learning in their classrooms. They were willing to create new structures to solve the problems associated with access to ICT tools and effective time allocation within the school context to accommodate the use of ICT for teaching and learning in their classrooms. The initiatives of the in-service teachers yielded positive results as they could access ICT tools to change their practice.

5.8 Summary

The analysis and discussion of the experiences of the in-service teachers on their learning and classroom practice provided a better understanding of how in-service teachers' pedagogical practices changed after their studies at a HEI and the contextual issues that influenced their practice in their schools. The findings establish similar issues identified in the existing empirical literature to some extent. However, this study's findings differ from the extant literature, pushing the boundaries of new knowledge and revealing new insights into the classroom practice of in-service teachers.

Firstly, this study found that in-service teachers made a pedagogical shift not because of the dictates of the ICT policy or curriculum imperatives but through vicarious observation and subsequent mirroring of the ICT methodology of their lecturers at Horeb university. In other words, modelling good practice through experience in their own classrooms and school context, thereby maintaining professional relevance, expertise, and identity.

Secondly, the learning experiences at the university led to valuable findings, which were the development of teachers' technological pedagogical knowledge (TPK). The in-service teachers did not envisage the type of ICT pedagogical learning experiences they had gained at the university. They adjusted swiftly to the demands of learning in a technology-rich environment at Horeb. This adjustment enabled them to learn and master the new ICT skills to survive academically in a higher education environment. The acquired ICT skills were relevant for their personal learning as students and significantly served to facilitate new teaching practices in their schools.

Thirdly, the findings of this study extended the body of literature on “teacher resilience” to sustain ICT pedagogical changes in practice. Refusing the role of bricoleurs (Freathy et al.,

2017), the in-service teachers in this study moved away from the traditional tools for teaching. They adopted ICT tools for teaching and learning. The in-service teachers were resilient, overcame various contextual challenges, and ensured that their technological pedagogical knowledge and skills gained at Horeb university were effectively practiced in different school settings.

Fourthly, the findings of this study avail further evidence of the suitability and applicability of the Activity Theory (Engeström, 1999, 2001) in exploring how the learning experiences of in-service teachers changed their pedagogical practices and the contextual challenges faced in integrating ICT into daily classroom teaching and learning activities. Furthermore, unintended outcomes in a research study extend the AT model.

The current study's findings contribute to and complement the body of literature which sought to explore teachers' pedagogical shifts in their practice, particularly in a developing country context. There is a dearth of literature on studies that investigate the preparation of in-service or pre-service teachers for the use of ICT in practice in Rwanda. Thus, this study makes a significant, unique and valuable contribution to the body of research.

6 CHAPTER SIX| CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS

6.1 Introduction

This chapter summarises the key findings of this study regarding the research questions and assumptions. Recommendations are made for practice, policy and research based on the findings of this study. The recommendations for teaching practice attempt to redefine the preparation of pre-service teachers for effective technology integration in their practice. This study's significant findings add to the body of research and are also highlighted. Furthermore, areas for further research relevant to the study focus are proposed in this section. The current study was positioned within the contexts of basic and HEIs, namely, a private university in Rwanda and primary schools in Rwanda, both public and private. The study set out to explore how the ICT learning experiences of in-service teachers influenced their pedagogical classroom practice. Thus, Responding to the main research question: “How does ICT as an instructional tool for in-service teacher training influence their classroom practice?”

6.2 Revisiting the purpose and context of the study

The purpose of my study is threefold, which I discuss at three different levels. First, on a personal level as a teacher educator in Rwanda, I have interest in understanding how ICT as a tool of instruction to in-service teachers may influence the decisions that they make about their classroom practice. I needed to understand how the learning experiences of in-service teachers within an ICT-enriched context may shape their practice. In this regard I intended to contribute to the body of literature that providing appropriate ICT learning experiences to teacher learners plays a significant role in influencing their future practice with ICT.

Second, on a professional level, my study needed to contribute to higher education particularly teacher training, by advancing a knowledge base for influencing and advocating the use of ICT for instructional purposes. This will facilitate the acquisition of required skills and meaningful learning experiences for students to develop competencies appropriate for the 21st century workplace.

My study also attempts to advocate for the formulation of ICT policies that are supportive, comprehensible, and effectively communicated to the policy implementers to achieve ICT integration in the policy curriculum as intended. The findings of my research may make a meaningful contribution to academic body by expanding the knowledge base on the experiences of teachers as learners.

I employed a holistic approach to examine the phenomenon in order to explore all related concerns from different dimensions. Therefore, this study was guided by one main research question. “How does ICT as a tool of instruction to in-service teachers influence their classroom practice”.

6.3 Summary of the emergent themes and findings

First was the journey of self-reinvention. Despite being gainfully employed, the participant in-service teachers in this study did not wait for policies or curriculum reforms to dictate the next step concerning their career or profession. Instead, based on self-evaluation of their practice and realising it was unsatisfactory, the in-service teachers decided to seek additional knowledge and further hone their skills. The in-service teachers attached the utmost importance to remaining professionally relevant by constantly “looking into the mirror” of self-criticism. The participants in this study strongly believed that equipping themselves with relevant content knowledge to improve their classroom practice could be achieved by enrolling for further studies at the university. They realised that maintaining professional relevance required engaging in life-long learning (Gemeda & Tynjälä, 2015), which positioned them to learn, unlearn, and relearn.

Second was the participant teachers’ ICT learning experiences at a HEI characterised by interaction with various ICT tools, navigating online learning environments, and observing lecturers’ practice. In response to the main research question, the current study's findings indicated that the in-service teachers had acquired unique ICT learning experiences while at Horeb university. The learning experiences of the in-service teachers in the current study were key to understanding how their interaction and learning with ICT during instruction influenced their practice. The acquisition of new ICT skills required to survive in an ICT-enriched learning environment laid the foundation for all other types of learning experiences that the in-service teachers had. Learning tasks were accomplished effortlessly

through the appropriate set of skills, and learning became more purposeful, interesting and engaging. The institutional learning management system (Sakai) failed to meet the learning expectations of the in-service teachers; therefore, Horeb university adopted Google Classroom. This decision served as a catalyst to facilitate alternative virtual learning when the in-service teachers returned to their various home-based schools, facilitating a blended learning approach. The decision to use Google Classroom as a pseudo-learning management system was advantageous to the university community, and both students and lecturers benefitted immensely from its usage. A significant aspect of the learning experiences of the in-service teachers was the opportunity to model the use of ICT for teaching by lecturers. Observing lecturers' methods of using ICT during face-to-face lecture sessions provided the in-service teachers with an opportunity to foster meaningful learning.

Third, the changed pedagogical practices of the in-service teachers, the culmination from the observation and learning experiences in using different ICT tools at the university, was instrumental in changing the perspective of the in-service teachers towards their inherent pedagogical methods of ICT for teaching and learning. The in-service teachers' learning experiences with ICT developed their technological pedagogical knowledge (TPK) and technological content knowledge (TCK), which promoted an almost seamless pedagogical transition from traditional approaches to technology-enabled practices. Their pedagogical practices of using ICT in the classroom became a more purpose-driven endeavour to prepare their learners for the 21st century workplace, which included teaching methods such as guided discovery, inquiry, and the collaborative constructivist engaging learners as active participants.

Fourth, the different school contexts provided restrictive and difficult environments for the pedagogical use of ICT for teaching and learning in the classroom. The absence of clear and comprehensively documented school-level ICT policies to guide the practice of the in-service teachers posed a great challenge to the implementation and sustenance of the newly acquired pedagogical knowledge and skills. The lack of school-based support added to the frustration and difficulties in accessing ICT tools during lesson delivery, pushed the in-service teachers to develop innovative ideas to solve the problems they faced in carrying

out daily teaching activities. The in-service teachers were resilient and determined to sustain their transformation to a new pedagogical approach.

6.4 Significance of the study

The new knowledge that emerged in this study was threefold in nature. Firstly, the in-service teachers transformed their classroom ICT pedagogical practice due to their experiences at the university, which was an unintended outcome of embarking on further learning. Secondly, the in-service teachers mirrored the good ICT practices observed by their lecturers at Horeb university. The lecturers' modelling of good ICT in teaching enabled similar ICT-enabled teaching strategies and techniques to be practised by the in-service teachers in their classrooms. Experiencing the use of ICT as instructional tools for both face-to-face and online learning at Horeb university changed the perspective of the in-service teachers about learning and, subsequently, their classroom practice. Thirdly, irrespective of the restrictive and constraining school environment, the in-service teachers in the current study demonstrated strong resilience towards integrating ICT into their practice.

This study extends the body of knowledge in that there is a dearth of literature on studies related to changes in teachers' pedagogical practices through mirroring modelling "good practice". Secondly, the study pushes the boundary on teacher resilience and perseverance to pursue the use of ICT even though the existing literature suggests that teachers often abandon ICT integration efforts in challenging and constrained teaching contexts.

6.5 Revisiting research assumptions

In chapter one of the current study, several research assumptions that emanated from the literature were highlighted. These empirical assumptions are now revisited in light of the findings.

- **Assumption 1**

Teacher education programmes need to help them to develop knowledge of good pedagogical practices, technical skills, and content knowledge to prepare teachers for effective technology integration (Koehler & Mishra, 2009).

The findings of this current study are similar to this assumption in certain aspects, such as content knowledge and technical skills. The teacher education programme equipped the in-service teachers with adequate content knowledge in the different areas of specialisation and the required technical skills. The ICT learning experiences of the in-service students at the university influenced their choices regarding using ICT for instruction in their classrooms. They used a wide range of ICT tools and resources in their classrooms to enhance learning and improve the experiences of their learners.

- **Assumption 2**

A shift in teachers' perception of change, their role in change processes, and openness to change are a prerequisite for achieving transformation in their practices (Ling & MacKenzie, 2001).

The findings from the current study support this assumption. Rather than being threatened by change, the in-service teachers perceived it as inevitable and prepared for it. The in-service teachers in this study embarked on a journey to re-invent themselves because they acknowledged the rapidly evolving education landscape and the importance of maintaining professional relevance in the face of these changes. The in-service teachers were willing to embrace change and accepted the responsibility to engage in professional development activities that would adequately prepare them to meet the expectations associated with change. The in-service teachers acknowledged their role as agents of change in the transformation of the teaching and learning landscape to meet the needs of the 21st century learner. Hence, they pursue the integration of ICT into their practice to achieve an enhanced pedagogical practice and create an enhanced learning environment for their learners.

- **Assumption 3**

Teachers' interest in the learning domains of subject content and subject-specific pedagogies increases towards mid-career (Louws, Meirink, van Veen, & van Driel, 2017).

The findings of this study do not concur with this assumption. The in-service teachers in the current study were early career teachers with an average teaching experience ranging from four to six years. The in-service teachers were beginner teachers and could not be

categorised as mid-career and desiring to acquire subject-specific content knowledge. The study revealed that regardless of the length of classroom experiences, the in-service teachers acknowledged the changing education landscape and opted to engage in activities that would ensure their professional relevance.

- **Assumption 4**

Teacher training programmes do not focus on the pedagogical practices in relation to ICT but on the development of ICT skills alone (Bingimlas, 2009; Kalogiannakis, 2010).

The present study's findings support this assumption. This study provides evidence that the teacher training programme successfully assisted the in-service teachers in developing pedagogical skills and knowledge that transformed their classroom practice. However, this finding was unintentional in the study. Through their teaching strategies and use of ICT as instructional tools, Horeb university lecturers modelled pedagogical practices that wove ICT into teaching and delivery of curriculum content. In the current study, the focus of the teacher education programme at Horeb university was not the development of pedagogical competencies; instead, the programme targeted ICT skills. However, observing the lecturers' practice and mirroring the same resulted in the changed pedagogical practices of the in-service teachers.

- **Assumption 5**

Well-designed professional development programmes utilising modelling approaches promote teacher learning (Darling-Hammond et al., 2017).

This assumption is confirmed and supported by the findings of the current study. The in-service teachers were enrolled in the teacher education program at Horeb university as a form of professional development. Professional development was instrumental in enhancing students' quality learning (Ghavifekr & Rosdy, 2015). This study revealed that modelling is an effective way of achieving changed practices among teachers. Professional development is required to help teachers acquire the skills needed to develop in their learners the competencies needed in the 21st century workplace. Modelling has been identified as one of the elements of effective professional development as teachers are presented with the similitude of best practices. The lecturers at Horeb university modelled

the types of ICT-enabled teaching strategies and learning experiences to be adopted when they returned to their classrooms to the in-service teachers. The knowledge and expertise acquired from Horeb university helped to create an enhanced learning environment for learners.

- **Assumption 6**

When learning experiences are focused solely on the technology itself, with no specific connections to content and learning goals, teachers are unlikely to incorporate technology into their practices (Ertmer & Ottenbreit-Leftwich, 2010).

The findings of this study corroborate this assumption. The learning experiences of the in-service teachers at Horeb university featured a meaningful interrelationship and connection between ICT, content and learning goals. The in-service teachers did not just learn “about” ICT, but they learned “with” and “through” ICT. The ICT learning experiences at Horeb university played a significant role in changing the perspective of the in-service teachers towards the pedagogical value inherent in ICT tools and ICT-enabled pedagogy in the classroom. Hence, the in-service teachers could successfully establish the connection between using ICT for teaching and learning and achieving learning goals, selecting appropriate ICT tools for specific contents (TCK) and effective use of ICT in the classroom.

6.6 Limitations

Limitations in any given study help the researcher to identify factors that may influence the study's findings. They are important in acknowledging and establishing peculiarities and boundaries inherent in a study. Limitations are identified and examined to determine what might have weakened the study's finding. Hence the findings should be considered carefully due to how the limitations may impact the results.

- Firstly, the investigation was carried out at an independent institution which was adequately funded and well-resourced with ICT facilities and infrastructure for student and staff use. The context may differ in public universities or other private universities.

- Secondly, the study is a cross-sectional study that spanned only two years. This may have influenced the results as the experiences of the in-service teachers may not sustain their practice as they proceed in their careers or after their studies.
- Thirdly, I acknowledge the researcher's presence in the classroom as a reactive observer may have influenced the behaviour of the in-service teachers or the learners.
- Fourthly, in this qualitative study, the eight study participants were chosen through purposeful and convenience sampling, restricting the research sites to schools that were easily accessible to the researcher. Hence the findings may not easily be generalisable to other contexts.

6.7 Recommendations

6.7.1 *Recommendation for Practice*

- **Schools**

Teachers must build stronger and more effective communities of practice targeted at identifying and sharing best practices within the schools. In-service teachers such as those in this study who take the step to further their studies and return to school with a new set of skills, knowledge and experiences should collaborate with other teachers in communities of practice to promote the transformation of practices within the schools.

The development of TPACK knowledge is necessary for teaching in a 21st century classroom context and may be enhanced through modelling. TPACK knowledge is impossible without teachers' constant exploration of technologies and teaching strategies that facilitate and support teaching and learning. Thus, teachers must continually strive to develop and strengthen these competencies by exploring emergent ICT tools and resources for teaching and learning.

There is a need for teachers as learners to be able to identify their learning goals. When teachers, as change agents, can discern the specific areas of learning that can enhance and improve their practice, transforming the classroom to accommodate the changes in the teaching and learning landscape to create a less challenging task.

- **Teacher training institutions or universities**

Teacher education programmes (particularly in Rwanda) should meet the ICT pedagogical needs of in-service and pre-service teachers. Evidence from the study suggests the need to review the teaching strategies taught during teacher training, focusing on developing teacher trainees' technological pedagogical knowledge competencies. This focus would improve the approach and outcome for the preparation of teachers for integrating ICT into their practice.

Students in teacher training institutions should be professionally involved in communities of practice that provide opportunities for peer learning and emulation of good ICT practices. Communities of practice may assist members in acquiring competencies and pedagogical practices for continual self-reflection, comparison, and improvement, maintaining similar practice and relying on other members for continual comparison.

6.7.2 Recommendation for Policy

Professional development initiatives targeted toward ICT integration for a changed classroom practice should be extended to all teachers, not just science or ICT teachers. Teachers of other subjects seem to be given less attention concerning professional development. Learning outcomes and experiences can be improved in all subjects using ICT; hence, all teachers should benefit from professional development initiatives regardless of the subject taught. This improvement would hasten a balanced achievement of the targeted education goals in the country and set the scene for improved learning experiences, and environments teachers are willing and ready to create.

Furthermore, a uniform standard of acceptable practice with ICT within teacher training institutions needs to be established and communicated to teacher training institutions regardless of their ownership status. This standard would ensure that both pre-service and in-service teachers country-wide are exposed to the same learning experiences and methods of instruction. Opportunities should be created for more hands-on and practical experiences with ICT tools and pedagogical infusion into real classroom situations for future practice.

Stakeholders and policymakers need to provide sustained support for ICT integration. Teachers must access implementable ICT policies and guidelines for using ICT tools and

resources within the school. This framework would give teachers more confidence to use the technology tools and prevent redundancy and reduced productivity. Hence, the availability of policies calls for adequate and regular professional development training for implementing such policies.

6.7.3 Recommendation for Research

Qualitative studies usually reveal more aspects that need interrogation, and areas of further studies usually abound. The integration of ICT is a vast landscape enriched with research possibilities for pedagogy and practice. Based on the findings of this study, some possible areas of further research were identified.

- How do in-service teachers' ICT communities of practice influence teachers' classroom practice?
- How do school-based professional development activities on ICT use influence teachers' TPACK knowledge?
- How do teacher training educators' pedagogies translate to teacher trainees' ICT practice?
- To what extent do teacher educators model or exhibit good ICT practices?

6.8 Conclusion

This study explored how ICT as an instructional tool for teacher training influenced in-service teachers' classroom practice. Essentially, this investigation was about how the ICT learning experiences of in-service teachers influenced their ICT pedagogical practices in the classroom. The exploration of the phenomenon was guided by one main research question and two sub-research questions. The answers to the research questions clarified the complex process involved in how in-service teachers' learning experiences with ICT as instructional tools resulted in the transformation of classroom practice. The present study highlighted how the acquisition of ICT skills, content knowledge, pedagogical knowledge and technological pedagogical knowledge translated and transformed their practice.

The argument in the research field revolved around the inability of Teacher Training Institutions to prepare teachers effectively for using ICT in their practice. Some schools of

thought emphasise the gap between the theory and actual classroom practice of teachers with ICT stemming from inadequate training due to traditional teaching methods in teacher training institutions. Other studies posit that the lack of required competencies among teacher educators, unavailability of ICT tools and lack of modelling are responsible for teacher trainees' feelings of inadequacy after completing their studies.

Through a holistic theoretical lens, the current study revealed that these narratives were slowly changing. The in-service teachers in this study experienced learning differently, and their learning experiences culminated in changed classroom practices within the schools where they were employed. New and more effective teaching styles were adopted, and their traditional teaching methods were seemingly abandoned. Furthermore, the in-service teachers could make more purposeful and effective use of the available ICT tools and devices.

Despite the constraints in terms of ICT tools and resources within the school contexts, the in-service teachers were determined to overcome all challenges and maintain the transformation to their practice. They developed and sustained a strong sense of resilience to pursue the use of ICT in their teaching repertoire, coupled with their passion for exploring and mirroring their newfound pedagogical approaches in their classroom practice.

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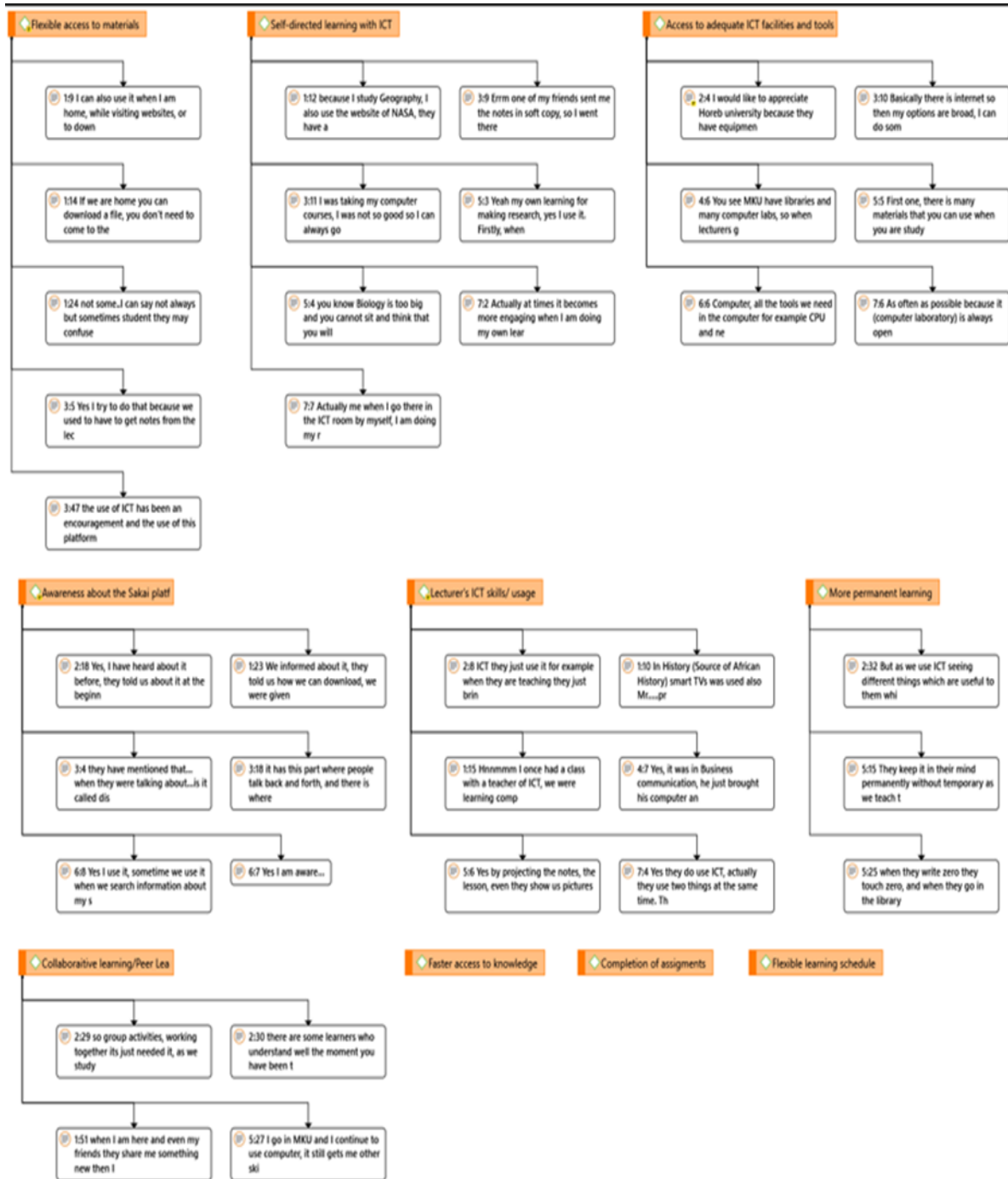
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7 APPENDICES

7.1 Appendix A: Data Analysis from Atlas Ti Coding



7.2 Appendix B: Letter of Consent to the In-Service Teacher



Faculty of Education
Department of Science, Mathematics, and Science Education,
University of Pretoria,
South Africa.

Date: 03/01/2018

The Teacher

Dear Sir/Madam

Letter of Consent to the In-service Teacher

I am a student (a graduate student under the supervision of Dr T Vandeyar) in the Faculty of Education; Department of Science, Mathematics, and Technology Education; University of Pretoria, South Africa.

I am conducting research to study **"The influence of ICT as a mode instruction on distance in-service teachers' classroom practice."**

Your participation will involve being interviewed and observed during the conduct of your normal classes as a teacher and during your study sessions as a learner, this may require the use of audio and video recording of your activities. Although I will try to be as unobtrusive as possible, I will require your valuable input both before and after the conduct of your lessons. I will try my best to ensure that the interviews do not exceed 45-60 minutes at a time. You will also be required to ensure that the essence of your input captured during the interviews is correctly recorded.

Your participation in this study is voluntary. If you choose not to participate or to withdraw at any time, there will be no penalty, and it will not affect your job or position in the school. The results of the research study may be published but your name or school will not be disclosed. There are no foreseeable risks or discomforts associated with your participation, if you agree to participate in this study.

There may not be any direct benefit to you. However, the possible benefit of your participation is the research findings and conclusions drawn from the study, will be made available to you.

If you have any questions concerning this research study, please call me on (250) 787316622 or email: tishylove@gmail.com

Sincerely,

ADEGOKE O.T

.....

I, _____ of _____

give my consent to participate in the above study.

_____ (signature) _____ (date)

7.3 Appendix C: Interview Protocol for Pilot Study

ADEGOKE Oyebimpe Toyin u17192171

Title: The influence of ICT as a tool of instruction on in-service teachers' classroom practice

Semi-Structured Interview

Protocol Questions

1. Life history:

Kindly you give me a brief history of your career as a teacher.

Prompts:

- What is your subject area(s) of specialization?
- Have you been teaching your subject(s) specialization?
- Your qualifications? Professional & Academic
- Years of teaching experience?
- Grades and Subjects
- Qualifications in ICT?

2. Personal learning through ICT

2.1 Do you use ICT for your own learning? Why? Why not?

2.2 Have you at any time had training on the use of ICT? (Literacy? when, and how long?)

2.3 Can you please describe all the ICT skills that you have acquired?

2.4 How did you learn these ICT skills?

Prompts: Courses? Self?

2.5 Did you learn by other means?

Friends? Interest groups? Colleagues

2.6 Which ICT tools do you prefer to use for learning?

Prompts:

- Technology access? Devices and Internet?
- Which do you use most often? Why?

2.7 Do you use ICT personally outside the classroom?

- For what purpose? Personal? Work related?

7.4 Appendix D: Redesigned Interview Protocol

ADEGOKE OYEBIMPE TOYIN U 17192171

Title: ICT as a Tool of Instruction to In-service teachers: Influence on Classroom Practice

Semi-Structured Interview Protocol Questions

1. *May I record our conversation please? Why am I recording?*
2. *Please note that your responses are neither correct nor incorrect. It is about your experience and I would really like to learn from you.*
3. *Your responses will be anonymously captured and your identity will not be disclosed to anyone.*
4. *The information from this interview is only for the purpose of research.*

1.0 Career History

1.1 Kindly give me a brief history of your career as a teacher.

Prompts:

When did you begin?

Have you taught in other schools?

- What is your subject specialization/combination?
- Is that what you teach in your school where you work?
- How many years of teaching experience do you have?
- Which grades/subjects do you teach/have you taught?

2.0 ICT Competence/Skills

2.1 Have you had any training on the use of ICT?

Prompts:

- When, how long was it?
- Why was the training organised/the focus?
- What did you learn how to do during the training?
- Who organised it? (School, district, you)
- If school or district, was it compulsory for you to attend?

2.2 Could you please describe your ICT skills that you have acquired?

Prompts:

- Why did you learn them?
- Can you describe your ICT skills? Hardware, software, internet?
- Did you teach yourself all these things that you have learnt about ICT?

3.0 These questions are related to the use of ICT for your own Learning

3.1 Do you use ICT for your studies? Please explain, why/ why not?

- Prompts: Which technological device/s do you use?
- Could you explain the purpose of which you use them for?

- Which of these devices do you prefer to use for your studies? why
- What other activities do you use them for exactly? Please describe

4.0 The following questions are about your classroom learning experiences with ICT

4.1 can you tell me in which course or lectures is ICT used. (How is it used)?

4.2 Do you use the computer laboratory for learning? Why/why not

Prompt:

Why, how often, for what purpose?

Which application packages or websites

Which hard ware devices are available for you to use?

Do you think the use of ICT for learning makes a difference to your learning?

Prompt: How? Why?

4.3 What type of ICT do your lecturers use?

Prompts:

Do they use online resources/internet/you tube/documentaries/images or e-books? Please think about all the lecturers and can you describe each?

Do you think their use of ICT influences your learning? Please explain.

4.4 Do you think that the way the subject content presented when ICT is used is different and when it is not? Please explain

4.5 Can you describe your feeling about lecture sessions when ICT is used and when it is not used? Please describe

Prompts: Do you feel like you are being carried along in the lesson or not? Describe how you feel.

4.6 Does the way (how) in which your lecturers/ teachers use ICT influence you to do the same in your classroom. (If you had the same technology at your disposal) in other words are you impressed by the way lecturers use technology or not? Please explain

4.7 In the cases where lecturers use technology (ICT) are the lectures more informative or interesting? Describe please

5.0 Experience with the Learning Management System

5.1 Do you know what a LMS is?

5.2 Are you aware that the university has a LMS?

5.3 How often do you use it? Is the system user friendly? Please describe your experiences with the LMS.

Prompts

- What are some of the difficulties that you experience with the use of ICT?
- Briefly describe your experience while using it. Do you find it easy to use?
- Prompts: Bandwidth, Navigation, devices....

6.0 Classroom Practice (Pedagogy)

6.1 Do you use ICT in your classroom?

- What made you to decide to use? Why? Kindly explain
- When did you start using ICT in your classroom?
- How often do you use ICT for teaching?
- Do you use it for all subjects or a few?

6.2 Are there advantages of teaching with ICT? Please describe with some examples. Do you foresee any disadvantages?

6.3 What type of technology devices/ hardware do you use in the classroom?

6.4 Do you use software packages?

Prompts:

- MS word, MS power point, VLC media player for audios or videos. For what purpose?
- Do you use any online resources? OER, Teacher education portals or websites?

6.5 Do you have access to the necessary ICT you need for your teaching?

Prompt:

Do you wish to have a particular type of technology? Why?

6.6 Do you think ICT makes a difference to your teaching? How? Please explain

6.7 Do you think ICT makes a difference to learners learning? How? Please explain?

- Why do you say so?
- Are learners using technology themselves in their lesson?

6.8 Do you think you made a pedagogical shift by using ICT? Please describe how your teaching has changed. In other words has your method/strategy/style changed since you started using ICT?

6.9 How do you go about planning your lessons when you teach to include ICT?

Briefly describe your experience when you teach with different ICT.

6.10 What aspect of your teaching has changed?

Prompts:

- Assessment
- Lesson delivery
- Evaluation

6.11 Do you think your experiences as a student-teacher/teacher-learner affected your practice?

6.12 Do you think your classroom experiences as a student learning through ICT at the university has influenced the way you teach? Please explain and give some examples.

7.5 Appendix E: Teaching and learning ongoing



7.6 Appendix F: Assignment Submission on the Sakai LMS

Feedback from lecturer as reflected by graded and ungraded assignments

Student	Submission Date	Status	Grade	Released
[Redacted]		No Submission		
[Redacted]	Apr 29, 2018 6:25 PM	Ungraded		
[Redacted]		No Submission		
[Redacted]		No Submission		
[Redacted]		No Submission		
[Redacted]		No Submission		
[Redacted]		No Submission		
[Redacted]		No Submission		
[Redacted]	Mar 31, 2018 4:52 PM	Returned	15.00	✓
[Redacted]		No Submission		
[Redacted]	Mar 19, 2018 10:53 AM	Returned	16.00	✓

7.7 Appendix G: Sample of Researcher's Journal

My Journal
<p>Date: 16th July 2018</p> <p>I created a WhatsApp group named 'Adegoke Research', and added all my participants to the group after obtaining their informed consent. This was to help me communicate with them faster and at the same time. They seemed happy to be a part of the group.</p>
<p>Date: 18th August 2018</p> <p>Activity: Transcription of interview (2nd Pilot study)</p> <p>Today I completed the transcription of the interview of the second pilot study. I conducted the interview on the 15th August 2018 with another male participant. This second pilot is needed due to the weakness of the first one. My supervisor had reviewed the first interview transcript and it revealed high levels of preemption. I guess my novice status affected me.</p>
<p>Date: 20th September 2018</p> <p>Activity: Interview</p> <p>Time: 9:30 am</p> <p>Venue: Student relaxation area</p> <p>I had an interview session with participant 3. Interview went well, however English seemed to be a big challenge in terms of expression.</p>
<p>7th October 2018</p> <p>Activity: Telephone conversation with participants</p> <p>I contacted my participants on phone to arrange on-site visit to their school. Some responded, others did not.</p>
<p>Date: 9th October 2018</p> <p>Activity: First school visit</p> <p>Venue: Holiness School</p> <p>The participant was excited to see me. Although the head teacher was absent, I was able to tour the school premises. Neat and welcoming school environment. I found pupils watching TV in the library. The school is four years old. The ICT laboratory was locked I could not see it.</p>

7.8 Appendix H: Document Naming Protocol

Pseudonym (School)	Pseudonym (Participant)
Holiness school	Daudi
Upper Kanazi school	Adeline
Lower Kanazi school	Nyansani, Yvette
Peace Academy	Divine
Success school	Oreofe
Great Oaks school	Longoria
Jambo Primary school	Sylvester

7.9 Appendix I: Identification and labelling of common themes and patterns

Themes	Categories and sub-categories
4.2.1 An inevitable journey of self-reinvention	4.2.1.1 The need to be “ahead of the curve”
	4.2.1.2 The lack of ICT competency
4.2.2: Navigating learning in an ICT – supported context	4.2.2.1 A technology-augmented learning milieu
	4.2.2.2 Acquiring new ICT skills
	4.2.2.3 Face-to-face (contact) lecture experiences <ul style="list-style-type: none"> • Perceptions of ICT-integrated lectures • Predilection for ICT supported lectures
	4.2.2.5 Self-directed learning with ICT: Learning how to learn
	4.2.2.5 New ICT-mediated learning experiences <ul style="list-style-type: none"> • A community of practice: <ul style="list-style-type: none"> ○ Collaborating from a distance ○ Peer support through ICT
	4.2.2.7 Navigating online learning spaces <ul style="list-style-type: none"> • Abandoning the university’s learning management system • Adopting a cloud-based learning management system
4.2.3: Two Worlds Apart: The influence of school context on teachers’ practice	4.3.4 Technology exigencies <ul style="list-style-type: none"> • Lack of access to ICT • Unstable electricity supply
	4.3.5 The dilemma of school rules and policy
	4.3.6 Professional development
4.4: Teachers as ICT agents of change	4.4.3 Mirroring good ICT practice
	4.4.4 Making an ICT pedagogical shift <ul style="list-style-type: none"> 4.4.4.1 Enhanced teacher confidence through ICT self-efficacy 4.4.4.2 Transformed lesson-planning strategies 4.4.4.3 Enhanced presentation techniques
	4.4.2.4 Embracing constructivist teaching approaches
	4.4.2.5 Teacher Resilience