Cape Peninsula
University of Technology

FACTORS INFLUENCING THE IMPLEMENTATION OF E-LEARNING TECHNOLOGY IN RURAL SECONDARY SCHOOLS IN SOUTH AFRICA

by

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Thesis submitted in fulfilment of the requirements for the degree

Master of Technology: Information Technology

In the Faculty of Informatics and Design

at the Cape Peninsula University of Technology

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Cape Town

January 2021

DECLARATION

I, Thifhuriwi Emmanuel Madzunye, declare that the contents of this thesis represent my unaided work and that the thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

Signed:  Date: 20/01/2021

ACKNOWLEDGMENTS

Firstly, I would like to thank the great God of Mount Zion for His grace, wisdom, guidance, and protection during this period. I would also like to thank the following people:

- Prof. Ephias Ruhode, my main supervisor, for his wise academic advice and support; and
- Dr Patricia Harpur, my main co-supervisor, for her wise academic and life advice, caring and support.
- My fellow master's students for their feedback, cooperation, and of course their friendship. Also, I would like to express my gratitude to my family (my siblings, my parents, and my wife) for all the prayers and encouragement.

  I would like to acknowledge the following people who always believed in me and pushed me academically:
- Mr Solmon Adeyemi Odunaike, my former lecturer for always believing in me and inviting me to the academic space.
- Mr Norman Madzunye, my brother who always guided me and helped me to understand the value of education.

In conclusion, I would also like to thank the community of Milton Mpfumedzeni Secondary School and John Mutheiwana Secondary School, together with the Limpopo Department of Education.

DEDICATION

This thesis is dedicated solely to my sister Adivhaho Madzunye. I love you.

ABSTRACT

This study identified a gap concerning factors influencing the implementation of e-learning technology in rural secondary schools in South Africa. Whilst real time online learning presents a possible solution for teaching and learning issues in rural areas, little is known about the implementation of digital strategies of schools in isolated communities. This study explores associated guidelines that have the potential to inform decision-making where Internet-based education could improve educational opportunities. Literature and data collection have been used as they have the potential to consolidate and collect interlinked data from specific sources in a structured manner. The following overarching themes emerged: Digital divide, Educational strategy, Human factors, and Support. Furthermore, findings of this study suggest that significant factors include: a lack of digital knowledge; infrastructure shortcomings such as a lack of computers; poor internet connectivity; and handicapped real-time online learning that may limit learners' progress. The study recommends that timeous consideration should be given to the influence of the digital divide. Additionally, the evolution of educational strategy that adopts digital approaches, focuses on training of role-players and stakeholders concerning human factors, and on the seeking of governmental funding and support that are essential for the implementation and success of e-learning technology.

Keywords: Communication, Digital divide, Digital skills, Distance, Educational strategy, Government, ICT, Learners, Limpopo, Lukalo, Network, Online learning systems, Political unrest, Real-time, Real-time online learning, Real-time online learning system, Resources, Rural Area, School, Teachers, Teaching and Learning, Training, Vuwani.

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GLOSSARY

CAL	Case A Learner
CAP	Case A Principal
CAT	Case A Teacher
CBL	Case B Learner
CBP	Case B Principal
CBT	Case B Teacher
CPUT	Cape Peninsula University of Technology
DC	Digital Communication
DD	Digital Divide
DS	Digital Skills
ICT	Information and Communication Technology
IT	Information Technology
JMSS	John Mutheiwana Secondary School
LDE	Limpopo Department of Education
MMSS	Milton Mpfumedzeni Secondary School
MO	Main Objective
PRQ	Primary Research Question
SQ	Sub-Question
O1	Objective 1
O2	Objective 2
RTOLs	Real-time Online Learning Systems

1 CHAPTER 1: INTRODUCTION

Real time online learning (RTOL) is an event where a group of learners and educators simultaneously engage online (Zydney, Warner & Angelone, 2020). In this study the term online learning is used interchangeable with the term real time online learning.

Online learning gives learners education opportunities to learn. Online learning offers several benefits. This method of learning especially benefits learners who reside far from campus (Pei Zhao, Sara Sintonen, Currie & Courduff, 2015), learners with busy work schedules, learners with family demands, and learners with other commitments (McDaniels, Pfund & Barnicle, 2016). Additionally, an online course is seen as an exceptional option for learners who prefer to study alone at a time that is convenient for them. Online courses provide excellent options for independent learners to work wherever they may be and whenever they find the opportunity (O'Donnell, Walmark & Hancock, 2010), Therefore real time online learning and online learning alternate as they both need a stable internet connection (Hodges, Moore, Lockee, Trust & Bond, 2020).

This study aims to explore guidelines associated with the implementation of real-time online learning. Furthermore, it addresses hindrances and facilitators of real-time online learning in a specific area of Limpopo in South Africa. This was accomplished by researching this concept within two schools, namely in a rural context of John Mutheiwana Secondary School and Milton Mpfumedzeni Secondary School in Limpopo, South Africa. The study investigated the nature of a conceptual model that addressed the possibility of systematic infrastructure shortcomings.

Factors such as a lack of computers, poor internet connectivity, and handicapped real-time online learning, may limit learners' progress.

1.1 BACKGROUND OF THE RESEARCH PROBLEM

Rural geographic areas are located outside towns and cities. These zones comprise sparsely populated, open land with few homes or other buildings (Ratcliffe, Burd

,Holder & Fields, 2016). Homes and businesses here are very closely clustered. There is also a lack of infrastructures such as electricity, transport and information and communication technology in most parts of the world especially the rural areas of many developing countries (Ampofo, 2020). These factors potentially affect most of the rural schools. For instance, the Deputy Minister of Education in South Africa describes schools in these areas as “characterized by numerous issues such as lack of infrastructures, political unrest, insufficient funding from the state and a lack of resources that harmfully influence the distribution of quality education” (Surty, 2014). Additionally, the rural schools are viewed as remote and relatively underdeveloped, resulting in poor and disadvantaged schools that lack the basic infrastructure such as transport, electricity, and information technology (ICTs) (Surty, 2014). However, rural areas are faced with various challenges with regards to real-time online learning, due to unawareness, insufficiency of infrastructures, resources, poor education, and poor leadership skills (McDaniels, Pfund & Barnicle, 2016).

John Mutheiwana Secondary School has recently been affected by protests due to political unrest, and as a result learner could not attend classes for some months. Milton Mpfumedzeni Secondary School, on the other hand, is in a deep rural area of Lukalo Village in Limpopo, and it accommodates learners from close-by villages, which at times make it difficult for learners to learn regularly, due to unreliable transport systems. These challenges affect students as they are unable to learn. Figures 1.1–1.4 below provide contextual information related to the environment associated with this case study.

Figure 1.1: Vuwani community during protest

Figure 1.2: School in Vuwani after protest

Figure 1.3: Bad road conditions to Milton Mpfumedzeni Secondary School

Figure 1.4: Newly improved Milton Mpfumedzeni Secondary School

1.2 STATEMENT OF THE RESEARCH PROBLEM

Online learning is the key for high school learners to study independently and research freely (Coomey & Stephenson, 2010). The real-time online learning process allows learners to conduct research, to learn, to contact lecturers or their fellows, based on their specific topics simultaneously and online learning give students an opportunity to go back and download recorded sessions and study material at a later stage. The researcher is a member of the context of the study. As such, he noted that emergent hindrances may affect the ability of learners to keep up to date. He noted that the lack of educational facilities that support real-time online learning educational opportunities, may have serious consequences for young, school-going learners. He observed that these educational challenges may include knowledge insufficiency, a shortage of digital skills from the educational stakeholders, incapability to use technology, and an inability to research online.

In addition to the hindrances mentioned above, communication is the most commonly encountered issue, due to unreliable internet connections and poor telephone lines, slow internet connection due to low bandwidth, and the number of devices connected to the network. Consequently, a key trial is that technical requirements should be kept to a minimum to raise chances for real-time online learning implementation (Perveen, 2016). Furthermore, concerning the opportunities, Perveen (2016) argues that informal access to all course resources is vital for both synchronous and asynchronous learning. The online-based e-learning platform can be divided into a triad of synchronous, asynchronous, and hybrid or blended learning environments.

However, whilst e-learning technology implemented as real-time online learning systems (RTOLs) present a possible solution for teaching and learning issues in the rural communities of Limpopo in South Africa, little is known about the guidelines concerning the factors accompanying such an implementation. Throughout this study the concepts e-learning technology and RTOLs are used interchangeably.

1.3 PRIMARY RESEARCH QUESTION, SUB-QUESTIONS AND RESEARCH OBJECTIVES

The primary research question is closely associated with and highlights the research problem. It was further divided into two sub-questions and two secondary research objectives. Sections 1.3.1 and 1.3.2 respectively address the primary research question and primary research objective and the associated sub-questions and secondary objectives.

1.3.1 PRIMARY RESEARCH QUESTION AND PRIMARY RESEARCH OBJECTIVE

The primary research question (PRQ) associated with the research problem is as follows:

PRQ: What factors influence the implementation of e- learning technology in rural South Africa?

1.3.2 RESEARCH SUB-QUESTIONS AND RESEARCH OBJECTIVES

The sub-questions (SQs) and research objectives (O) that were researched in support of the main research question (PRQ) and objective (MO) are tabulated in Table 1.1.

Table 1.1: Research questions and objectives relative to this study

Research Questions	Objectives
PRQ: What factors influence the implementation of e- learning technology in rural South Africa?	**MO:** To explore guidelines that inform the implementation of real-time online learning in rural South Africa.
SQ1: What factors could hinder the successful implementation of e-learning technology in the rural areas of Vuwani and Lukalo in Limpopo in South Africa?	**O1**: To identify the factors which adversely affect real-time online learning success in two specific rural areas in Limpopo in South Africa.
SQ2: What factors facilitate the implementation of e-learning technology established in the rural areas of Vuwani and Lukalo in Limpopo in South Africa?	**O2:** To investigate the factors which enable real-time online education in two specific rural areas in Limpopo in South Africa.

The table above outlines the primary research question (PRQ) together with two sub-questions (SQ1 and SQ2) that are linked to two objectives (O1 and O2) for this research.

1.4 RESEARCH DESIGN, RESEARCH METHODOLOGY, AND RESEARCH METHODS

1.4.1 RESEARCH CONTEXT

A case study approach is used as it provides the strategy for a 'slice-in-time' platform and opportunity for the gathering of sufficient rich and thick data (Creswell, 2014) to address the research questions of the study. The qualitative research design seeks to understand educational phenomena in a schooling environment, mediated socially and informally by emerging educational technologies. Following a case study strategy, a case study protocol was developed (Yin, 2012) and served to guide the empirical component of the research design.

The exploratory case study neither focused on communities of practice, nor on the establishment of a controlled digital learning project, implemented in schooling contexts. Contrary, the study was conducted in a natural context and aligned with the viewpoint of Dahlbom and Mathiassen (1993:225).

They had advised that this approach supports an understanding of the complex interplay among people, methods and technology, and the important role of interpretation, personal interests, and values.

For this study, a combination of views outline the concept 'case study' as a multi-method/triangular approach to data collection (Robson & McCartan, 2016) delineating empirical aspects. It provides an opportunity to explore the implementation hindrances and facilitators associated with real-time online learning in a specific context (Al-samarraie, 2019), that is characterized as a complex and contemporary phenomenon (Höst & Runeson, 2007) with shifting and indistinct boundaries. A small and focused group of stakeholders was drawn from two schools in a natural context – Vuwani and Milton Mpfumedzeni, constituting a non-probabilistic sample of convenience (Oates, 2005).

This study explored two cases, namely **John Mutheiwana Secondary School** and **Milton Mpfumedzeni Secondary School,** which are both situated in rural areas of Limpopo in South Africa.

John Mutheiwana Secondary School were recently affected by strikes due to political unrest and this affected learning. Residents of Vuwani have been striking for service delivery and have also refused to be under Malamulele Municipality. They feel that they deserve to have their own municipality which would improve service delivery. As a result, there have been many protests and learners could not attend classes for some months.

Mpfumedzeni Secondary School is situated in Lukalo village, a deeply rural area in Limpopo. It accommodates learners from close-by villages. These learners daily rely on public transport to go to schools. Some learners have to walk a long distance to school. At times it is difficult for learners to learn regularly, due to the unreliability of public transport and this affects learning. This represents a good opportunity for exploring real time online learning in these two schools as it will seek to solve the current educational challenges.

1.4.2 RESEARCH DESIGN

The study uses a qualitative methodology, where data was collected via semi-structured interviews (Saunders, Lewis & Thornhill, 2008). The reason for using a case study was to gain an in-depth understanding of the phenomena of research. This qualitative study focuses on and adopts an inductive approach. The research strategy is based on understanding and gathering in-depth information (Pietkiewicz & Jonathan A Smith, 2012), which produces thick and rich data (Creswell, 2014). The interpretive approach deals with participants' experiences, opinions, and points of view related to the subject of research (De Villiers, 2012). The design relies on the selected interpretive research paradigm, using a case study as an ideal strategy.

This strategic choice was justified as it focuses on real-life setting, which provides an understanding of the meaningful characteristics of the actual situation, such as people's lives, and institutional and managerial processes (Almalki, Centre & Arabia., 2016). Furthermore, Saunders et al. (2007) outline that an interpretive qualitative case study is an underlying principle in selecting appropriate cases, as the reference for information-rich cases concerning the topic under investigation results in the use of purposive sampling.

1.4.3 THE RESEARCH INSTRUMENT

This study uses observations, paper-based questionnaires, and semi-structured interviews as it allows the interviewee to explain and provide more information based on the research phenomena (Clarke & Clarke, 2013). Interviews can also be used as data collection tools (Obeid, Mcgraw & Minor, 2013). Semi-structured interviews enable the collection of thick and rich data, supporting the exploration and achievement of a deep understanding of emergent themes and concepts (Keeffe, & Mijic, 2016).

1.5 DELINEATION OF THE RESEARCH

This study focuses only on two specific rural areas in Limpopo South Africa, namely Vuwani and Lukalo. However, the study did not investigate whether learning occurred. This study did not develop a solution to current educational problems in Limpopo. Instead, it proposes a set of guidelines that addresses hindrances and embraces facilitators to be considered before future implementations.

1.6 SIGNIFICANCE OF THE RESEARCH

The study proposes guidelines for the implementation of a real-time online system in two specific rural areas in Limpopo in South Africa. This research concerns the hindrances and facilitators associated with real-time online learning systems in rural communities, thus contributing to the body of knowledge in the e-learning discipline. Although this case study was conducted in one rural context in South Africa, it holds potential value for other rural zones.

1.7 EXPECTED OUTCOMES

This study was expected to provide a guideline towards the implementation of real-time, online learning systems in rural South Africa. Furthermore, the study consolidates current literature, extending and supporting theoretical premises. Additionally, it provides an opportunity for further doctoral research and it also supports the publication of journal articles and conference papers.

1.8 LIMITATIONS OF THE STUDY

The distance between Cape Town and Vuwani (John Mutheiwana Secondary School) and Lukalo (Milton Mpfumedzeni Secondary School) in Limpopo to collect data was a major limitation for this study. Additionally, this contextual study focuses only on a real-time online system in two rural areas in Vuwani and Lukalo in Limpopo in South Africa. A qualitative approach was followed by a multiple-case study strategy to propose a general model, which could be used to inform the implementation and adoption of a real-time online learning system.

1.9 ASSUMPTIONS

In this study, the researcher assumes that the future implementation of a real-time online learning system may be beneficial to learners in the rural area of Vuwani and Lukalo in Limpopo. The researcher also assumed that the interviewees would give the interviewer time for data collection and answer all questions truthfully.

1.10 CONTRIBUTION OF THE RESEARCH

This study contributes methodologically, substantively, and scientifically to the body of knowledge.

Methodologically, it assembles strategies from various disciplines to produce methodical literature reviews, extending the application of the case study method to explore guidelines for the implementation of the real-time online learning system.

This study offers substantive and categorized strategies for all institutional decision-makers – strategic, tactical, and operational – regarding best guidelines for real-time online learning for schools in rural areas.

Finally, the scientific contribution of the study vests in the theoretically- and empirically-determining guidelines for the implementation of real-time online learning systems, addressing potential hindrances and motivational facilitators.

1.11 ETHICAL CONSIDERATIONS

For this research project, the research fully complied with the ethical principles of the Limpopo Department of Education (LDE), following the general principles for scientific research precisely in the process of data collection, data analysis, interpretation, and enforcing of confidentiality. The research participants for the study were selected fairly and unbiased.

The participants were informed about the research study and asked to provide their approval before becoming part of the research. This research study assured confidentiality and integrity of the participants by protecting their privacy assuring that

no harm came from a breach of the participants' privacy. For instance, Babbie (2010) argues that ethical consideration in research is based on the confidentiality and anonymity of participants. This research, therefore, presented only anonymized data, generally in a summarized form. This ensured that the benefits easily outweighed the risks, which are a common concern when considering ethical dilemmas.

An ethical clearance letter was obtained from the Limpopo Department of Education and from the Cape Peninsula University of Technology's ethics review committee to conduct the data collection. Thereafter, an informed consent letter requesting permission to collect data was sent to the participants. The consent letter also clarified that the participants could withdraw voluntarily at any time without giving their reasons.

The following has guided this study in terms of ethical consideration:

- Informed consent
- Clearance from LDE
- Clearance from the Cape Peninsula University of Technology.

1.12 CHAPTER SUMMARY

In this section, the problem statement, research aim, research objectives, research questions and research aim have been acknowledged. The next chapter will be a literature review relevant to the study.

2 CHAPTER 2: LITERATURE REVIEW AND THEORETICAL FRAMEWORK

The previous chapter introduced this study, which is based on the guidelines for the implementation of a real-time online learning system in rural areas of Limpopo. To achieve this, a case study of both Vuwani and Lukalo was undertaken. One main research question and two sub-questions were addressed, together with two objectives to provide those guidelines. This chapter presents a review of the relevant literature, to understand the research that was done previously, what research is currently being done, and to address similar phenomena. The focus themes will include Digital Divide in Section 2.1, Educational Strategy in Section 2.2, Human factors in Section 2.3, Support in Section 2.4, and a Conceptual model supporting the study in Section 2.5.

2.1 DIGITAL DIVIDE

The digital divide can be defined as the gulf between people who already have access to technology and those who currently do not have access (Hillier, 2018). The first important concern is who has access currently and who does not have access to the internet and as a result they cannot use real time online learning as it really on internet access (Bray, 2016); what encourages people to utilize the internet (Loh & Chib, 2017); what blocks their use; and lastly, what characterizes those people who decided to stop using the internet service (Rice, 2002). Concerning skills, Heeks (2019) pronounces digital knowledge as a set of elementary skills, compulsory for working with digital media – the process of processing, and retrieving information. Digital knowledge also enables people to create and share knowledge through social networks, and it gives them the ability to support an extensive range of specialized computing skills (Martin & Grudziecki, 2015).

One proposed solution from previous studies is that digital villages and other creativities such as support from some organizations like the Bill Gates Foundation, have implemented the process to bridge the digital divide in the rural areas (Dijk & Van Dijk, 2019). Universities are also expected to play a major part in producing graduates who are more than just computer literate, but are also computer competent and

therefore they can also go back and educate more people (Swaab, Galinsky & Medvec., 2012).

2.1.1 MATERIAL ACCESS

To study the material access divide, there must be a proper understanding of who has access to some specific materials as this allows students and teachers to have access to material and they can be able to utilize real time online learning.

2.1.1.1 RESOURCES LIMITATION AS A CAUSE FOR DIFFERENCES IN MATERIAL ACCESS

For material access, financial status plays an important role including that of accessing real-time online learning (Jiang , Zhang , Liu , & Zhao, 2019). This is mostly due to the income required to be able to acquire Internet access. It is expected that people with better incomes will own a multitude of digital devices (Deursen & Dijk, 2019). They own better digital devices compared to those with lower or no incomes (Deursen & Dijk, 2019). People with low incomes are likely not to own any digital device (Jiang , Zhang , Liu , & Zhao, 2019). Although the majority of people with low income also use digital technology, access is unstable and unsustainable (Gonzales, Calarco & Lynch, 2020). Different aspects need to be taken seriously when focusing on material access. Those aspects include differences in device opportunities, or a device replacement with one that has better technical capacities, the difference in diversity of devices, and the difference in costs of maintaining those devices (Deursen & Dijk, 2019). The most studied aspect is technical capacities between desktop computers and laptop computers, versus those of smartphones and tablets (Sathishkumar, Radha, Saravanakumar & K. Mahalakshmi, 2020).

Mossberger and Tolbert (2012) indicate that smartphones and tablets have advantages such as mobility, convenience, and more continuous internet access. Furthermore, Loh and Chib (2017) indicate that smartphones and tablets are no substitute for desktops as they offer lower memory, less storage capacity, and relatively low speed. Smartphones and tablets also provide the user with less control

of Internet usage as some platforms are embedded in closed systems (Lutz, 2019). Furthermore, Clayton and Murphy (2016) added that the smaller size of their screen, greater scrolling requirements, and difficulties in typing, make them less favourable, as there is a low level of user-engagement and an inability to create content. Some device combinations are found to be less likely compared to others. As a result, desktop and laptop computers allow the user to participate in a greater range of opportunities (Deursen & Dijk, 2019).

2.1.1.2 AGE AND GENDER AS CAUSES FOR DIFFERENCES IN MATERIAL ACCESS

The most-observed personal categories affecting Internet access are age and gender (Scheerder, van Deursen & van Dijk, 2017). In the developed world, usage of the Internet either by men or women, is continually increasing, because they are faced with the same digital technology at their workplaces, school, and at home and this would increase the opportunity for the usage of real time online learning (Van Dijk, 2017). However, gender remains a substantial factor impacting Internet usage over time in most countries that have high Internet penetration (Helsper and Reisdorf, 2017). Women and adults are seen to be less technologically competent according to Chiang and Dholakia (2003). For the younger users the Internet is seen as essential in their day-to-day operations, because they are motivated, have access to devices and connections through visiting libraries, their willingness to upgrade their skills, and it is an ideal usage of online communication (Onitsuka, 2018). Furthermore, Onitsuka (2018) added that even though older users may have access to devices and connections, they have a lack of motivation and skills compared to younger users and they do not feel that the Internet is essential for their day-to-day life. Persons aged between 15 and 24 use the internet daily, whereas persons aged between 45 and 54 are likely to use the internet once a month (Deursen & Dijk, 2019).

2.1.2 INTERNET ACCESS

To study internet access in the digital divide, we need to understand the factors that contribute to internet access. Internet adoption has reached a saturation point in the younger population, but internet access remains a serious issue in older populations (Media & Friemel, 2015). Internet access is classified by sociocultural and financial differences, older users, female users, racial subgroups, uneducated, unemployed, and those that have low income are less probable to be online (Deursen & Dijk, 2019). However, Helsper and Reisdorf (2017) argue that these internet access gaps may be temporal and not last forever – they may be generational. The majority of the population is disconnected, because of a lack of internet access at home and this affects them badly as they cannot study or even work from home (Letseka, Matsephe & Pitsoe, 2018). Those with internet access are more likely to be able to stay connected online, study from home, and even work from home and this gives an opportunity for real-time online learning (Piatak, 2018).

2.1.3 SKILLS AND DIGITAL LITERACY

There is a need to understand how skills and digital literacy contribute to the digital divide.

There are limited skills and digital literacy in low-income communities, due to lack of access to devices and infrastructures (Handley, 2018). Internet usage of low-income communities slowed down as a result of non-use, identified as fewer digital skills and lack of internet knowledge (He, Boas & Mol, 2017). People with a low level of digital literacy have less courage and ability to use digital devices (Deursen & Dijk, 2019). The lack of digital training and support from the government also contributes to the majority of people not having enough digital skills and digital literacy (Loh & Chib, 2017). Furthermore, Lutz (2019) argue that younger people are more willing and keen to get digital training compared to older people.

2.1.4 RACIAL GAP

Studies show that race affects the digital divide by the differences in computer and Internet access that were caused by different income, background and occupation, and this contributes noticeably to the majority of black people (Fairlie, 2014). There is a big gap between black and white communities when it comes to home computer and Internet access (Dijk & Van Dijk, 2017). Furthermore, there is a difference in digital access to digital devices between races, which is also noticeable in the differences between schools in a rural area, and schools in urban areas (Fairlie, 2014). All these factors are responsible for the remaining gaps.

2.2 EDUCATIONAL STRATEGY

The United Nations' Educational, Scientific and Cultural Organization's (UNESCO) Strategy on Teachers 2012–2015 emphasized the importance of implementing policies that will ensure that qualified teachers are hired. The role of teachers in preparation and building of high-quality education is handicapped by the shortage of highly qualified educators (McCormick, Brady & Morris, 2019) Additionally, the absence of capable educators supports additional concerns regarding the quality of education such as congestion and high learners'/educators' percentages. Lack of well-trained teachers according to national standards, contributes to less quality education. "Rural education is always a zone of excessive concern to those who make policies and the residents who resides in rural areas" (UNESCO Strategy on Teachers, 2012, p. 2). Some of the researchers indicated that even though rural schools and urban schools are frequently equal in poverty and a lack of resources, the majority of the current literature focuses on the understanding of urban school regions (Gallo & Beckman, 2016). UNESCO (2015) argues that without proper policies that are personalized for the exclusive background of schools in rural communities, it is problematic to guarantee the equity of access, resources, and opportunity in schools (Gallo & Beckman, 2016).

2.2.1 STRATEGIES TO PREPARE PRESERVICE TEACHERS

There is a need for teachers to be well prepared before they can deliver any lesson. There are many different strategies that can be used to prepare pre-service teachers for Technological Pedagogical Content Knowledge (Mouza, Karchmer-klein & Nandakumar, 2014). There is a need for the following conditions that are necessary on the institutional level: Technology planning, Leadership skills, Staff training and access to resources, and Cooperation within and between the institutions (Lee, Ri Son, Kim & Kyung, 2016).

2.2.2 TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE

Teaching is a complicated exercise that requires an interweaving of using different specialized skills and knowledge and this is essential for real time online learning to take place (Koehler, Mishra & Kereluik, 2014).

2.2.2.1 THE CHALLENGES OF TEACHING WITH TECHNOLOGY

Teaching new technology is always complicated and it also comes with challenges to teachers. Social and contextual factors also complicate the relationships between teaching and technology. Social and institutional backgrounds are often obstructive to teachers' efforts to integrate the use of technology into teaching and learning (Koehler et al., 2013).

2.2.2.2 PEDAGOGICAL KNOWLEDGE (PK)

Pedagogical knowledge (PK) is the teachers' highest knowledge about teaching and learning processes and practices or methodologies (Mulholland, 2014). They incorporate, among other things, general educational purposes, values and aims. This common form of knowledge applies to the process of understanding how learners learn, how to manage a classroom, teacher's management skills, teacher lesson-planning skills, and learner assessment (Hwang, Hong, Jon-chao Hao & Yung-wei, 2018). It comprises knowledge about techniques or approaches used in the classroom

environment; the nature of the target audience; and evaluating strategies for learners' understanding. A teacher with high pedagogical knowledge understands how learners build knowledge and acquire skills and how they develop positive behaviours toward learning (Mulholland, 2014). Therefore, pedagogical knowledge requires an understanding of cognitive, social and developmental theories of learning and how they apply to learners in the classroom environment (Qiao, Yu & Zhang, 2018).

2.2.2.3 PEDAGOGICAL CONTENT KNOWLEDGE (PCK)

PCK is consistent and comparable to Shulman's idea of knowledge of pedagogy that is related to the teaching of certain content (Qiao, Yu & Zhang, 2018). This transformation happens as the teacher understands the subject matter, finds different ways to deliver it, and familiarizes and tailors the instructional materials to substitute conceptions and learners' prior knowledge (Schmidt, 2017).

2.2.2.4 TECHNOLOGY CONTENT KNOWLEDGE (TCK)

TCK refers to the ability of teachers to understand how to use a specific technology, This can change how learners understand and grasp concepts in some specific content area (Schmidt, Thompson & Koehlerl, 2016).

2.3 HUMAN FACTORS

When it comes to the advent of any new technology, perception, attitude and intention to adopt are relatively low (Van Dijk, 2017). There are some motivational factors in the adoption of new technology, and most of them are social or cultural with a mental or psychological nature. An initial social clarification was that "the Internet access does not have demand for low-income and uneducated people" (Rice, 2002).

Self-effectiveness has shown to influence how individuals behave towards any execution of the action. This is an individual's beliefs about their capabilities of performing a particular task such as using real-time online learning or technology (Mbarek & Zaddem, 2013).

2.3.1 LEARNERS' ACCEPTANCE OF ONLINE LEARNING

Several studies have revealed that the implementation of e-learning is not simply a technological solution, but a progression of multiple factors such as social and behavioural contexts (Ouyang & Stanley, 2014). The successful implementation of e-learning and usage of real-time online learning would depend on the attitude and perception of teachers and learners and also their digital knowledge and skills. Major factors have shown effects on users' initial acceptance of digital devices (Van Dijk, 2017).

The Technology Acceptance Model (TAM), introduced by Davis (1986), is an information systems model that shows how learners and teachers adapt and accept the use of technology (Gerhana, Yana Aditia Irfan, Slamet & Cepy, 2017). It uses the endpoint where everyone is expected to be able to use technology. This can be achieved by forming Behavioural Intention, which is a factor that influences people to utilize the technology (Liu, 2016). This model is based on social psychology theory specifically, and the Theory of Reasoned Action (TRA) (Ajzen, 2015). Once teachers and learners accept technology, digital learning became possible (Madden, Ellen & Ajzen, 1997).

2.3.2 SOCIAL INFLUENCE

Social influence is a mutual feature of our everyday life: either we are influenced by others, or we influence them in so many different ways and many times each day (Smith, 2014). Social influence comes in many different forms and can be observed in processes of conformity, socializing, peer-pressure, obedience, organization, leadership, classes, persuasion, politics, minority influence, and social change (Fischer & Vaulair, 2011).

2.4 SUPPORT

Due to the lack of resources from libraries, most of the teachers and learners only use the internet for the sake of acquiring information related to their studies since libraries are unable to offer them satisfactory and recent materials (Kamba, 2018).

A growing change in market liberalization of access to the internet is leading to alternative generous 'digital divide' on the global scale. Many countries have introduced, or are familiarizing telecommunications guidelines that reduce the growth of access to Internet service for real-time online learning to be a success. It needs to shape on another significant pillar: the presence of infrastructure together with some degree of internet connectivity (Furuholt & Saebø, 2018).

With the development of ICTs, real-time online learning delivers instant and flexible long-distance learning to the learners (Hadullo & Oboko, 2018.), The lack of support from the government at all levels indicates less money is put towards real-time online learning and education as a whole (Bray, 2016). Resource allocation disparity is also a serious problem. This is seen as less support and motivation from the government.

2.4.1 ICT INFRASTRUCTURE FOR REAL-TIME ONLINE LEARNING SUPPORT

Regarding the situation of information and communication technology (ICT) infrastructure, the government is less involved, or not involved at all when it comes to rural communities. There are still some schools that receive less support when it comes to ICT infrastructure (Khan & Ambani, 2016). A significant percentage of the population does not have reasonable access to ICTs. This is due to historical factors and dominant policies that undermined rural communities (Albar & Hoque, 2019). Even though the South African Post Office (SAPO) also plays a major role in providing access points for ICTs in rural areas, the effort is not enough to support rural schools. Schools do not have adequate infrastructures like computer labs, internet connections, and electricity that could support real-time online learning (Letseka, Moeketsi, Matsephe & Pitsoe, 2018).

2.4.2 ELECTRICITY ISSUES

Electricity plays a huge role in our lives. Whether it is at work, home, school, road infrastructures, hospitals or shopping malls, our day-to-day routines rely seriously on electricity (Zohuri, 2019). The unstable supply of electricity in rural areas makes it difficult for schools in rural areas to have access to e-learning. Furthermore, the cost of electricity is also seen as a challenge in rural communities where there is a high level of unemployment (Van Dijk, 2017). With the implementation of load shedding by the electricity supply commission ESKOM since 2008, businesses and schools have been affected (Steenkamp, Taylor, Hollis-turner, Bruwer and Juan-pierré, 2017).

Even though the majority of schools have electricity, without any power backup generators, electricity will remain an issue and that may affect online learning from time to time (Albar & Hoque, 2019). According to Cambridge dictionaries online (2016), communities and schools in rural areas are also faced with power outages, due to power failure. The longer ESKOM takes to fix power outages is a serious challenge as it may negatively affect online teaching and learning (Steenkamp et al., 2017).

2.4.3 INTERNET BANDWIDTH

The broadband network coverage in rural areas is limited due to the high cost of wired fibre access that the majority of individuals cannot afford. Therefore, schools in rural areas are not able to use the broadband network capacity (Byanyuma, Mastidia, Zaipuna,Simba & Trojer, 2018). In most countries, broadband connectivity has always been a challenge, especially in the rural areas of developing countries (Herselman & Africa, 2018). However, connectivity is not a problem in urban areas and big cities, because governments have consistently made sure that good connectivity remains priority (Byanyuma et al., 2018). South Africa is classified as a devolving country and it is affected by internet connection restrictions which make online learning impossible (Harpur & De Villiers, 2012).

2.4.3.1 SUSTAINABLE INTERNET ACCESS

Maintaining and sustaining an Internet service is a challenging task in South Africa and all other developing countries (Byanyuma et al., 2018). Lack of government support results in unstable internet access in rural communities (Herselman & Africa, 2018). Even though there have been some projects that were supported by international donors to supply internet to rural areas, the real challenge is to make those projects sustainable (James, 2003). Furthermore, Quaicoe and Pata (2020) add that internet access sustainability will require the government to establish a project aimed to deliver low-cost Internet to rural area schools and communities. This may bridge the digital divide as people in rural areas are usually poor and only a few can afford to sustain their Internet connections from home (James, 2003).

2.4.4 LACK OF LIBRARY FACILITIES AND DEVICE ACCESSIBILITY

Nowadays computers and digital devices are crucial in the educational environment, therefore, it is very difficult for computer illiterate people to complete their tertiary studies (Herselman, 2018). In most rural schools, it is unlikely that you will find a computer lab, let alone someone with knowledge of the Internet, unlike urban schools (Sharma, Shaukat & Furlonger, 2015). Yet the Internet could be used to bridge the gap between rural and urban schools by using educational websites and lectures via satellite. The library is a common resource in most urban schools and areas. Most rural communities do not even know what a library is, let alone what its function is (Campana, Mills, Janet, Capps & Cherly., 2016). Establishing a library in schools will help improve the literacy rate and enhance rural education. These libraries can eventually evolve to include computers to help train scholars in computer literacy (Campana et al., 2016).

2.5 CONCEPTUAL MODEL

Real-time online learning gives learners an exciting initiative that focuses on improving learners' commitment. The system allows learners time to participate in realistic activities. It is built around the principles of extensive education where engagement

occurs that gives learners a sense of connection to others and a level of control over their learning (McBrien, Jones & Cheng, 2009).

This research is guided by the following conceptual model, as shown in Figure 2.1.

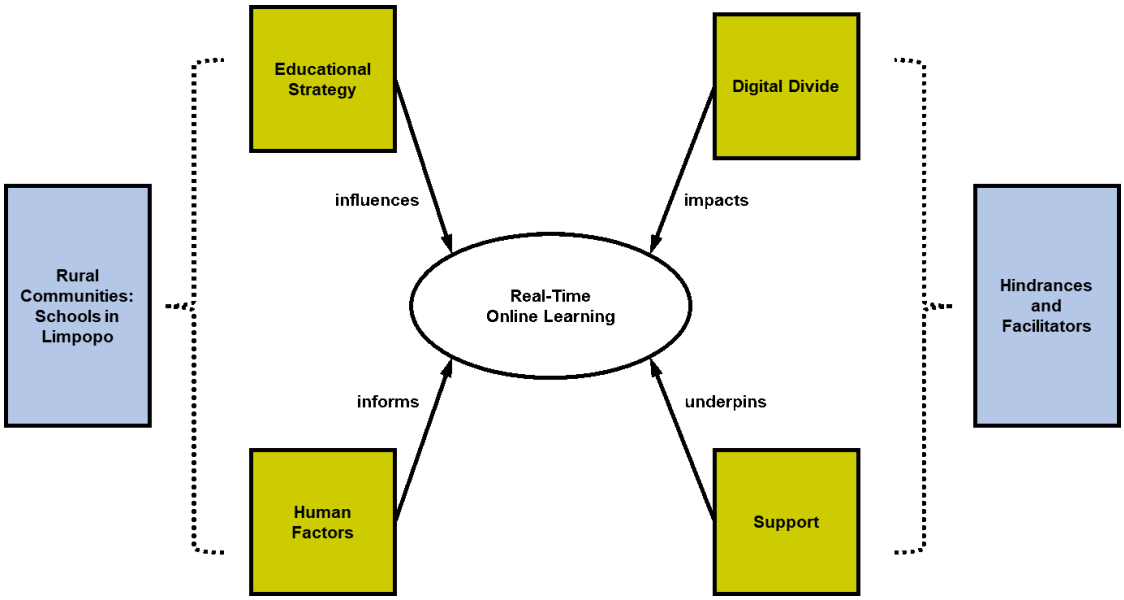

Figure 2.1: Conceptual Model

Figure 2.1 above outlines a conceptual model that addresses the digital divide, educational strategy, human factors, and support. The model suggests that real time online learning is influenced by digital divide, educational strategy, human factor, and support, however it may be hindered by lack informative implementation guidelines, highlighting infrastructure requirements, availability of computers, adequate internet connectivity, and the nature of handicapped online endeavours. These issues may limit the success of real-time online learning. Additionally, real-time online learning systems may present opportunities that improve teaching and learning experiences.

This conceptual model is an overview of themes that emerged during literature review, it did not earn to specifically set out what the literature had to say about the positive analysis, however table 2.1 below details the factors that emerged from those literature, furthermore from the literature each of this high-level theme can be connected to the factors listed in the table.

Table 2.1: Themes and factors

Theme	**Factors**
Digital divide	• Material access. • Internet access. • Skills and digital literacy. • Racial gap.
Educational strategy	• Strategies to prepare preservice teachers. • Technological pedagogical content knowledge.
Human factors	• Learners' acceptance online learning. • Social influence.
Support	• ICT infrastructure for real-time online learning support. • Electricity issues. • Internet bandwidth. • Lack of facilities and device accessibility.

Table 2.2 below poses and confirms the objectives and research question.

Table 2.2: Sub-questions and research objectives relative to this study

Research Questions	Objectives
PRQ: What factors influence the implementation of e- learning technology in rural South Africa?	**MO:** To explore guidelines that inform the implementation of real-time online learning in rural South Africa.
SQ1: What factors could hinder the successful implementation of e-learning technology in the rural areas of Vuwani and Lukalo in Limpopo in South Africa?	**O1**: To identify the factors which adversely affect real-time online learning success in two specific rural areas in Limpopo in South Africa.
SQ2: What factors facilitate the implementation of e-learning technology established in the rural areas of Vuwani and Lukalo in Limpopo in South Africa?	**O2:** To investigate the factors which enable real-time online education in two specific rural areas in Limpopo in South Africa.

The table above outlines the main research question together with two sub-questions that are linked to two objectives for this research.

2.6 CHAPTER SUMMARY

In this section, the literature review has been reviewed and the research questions were identified for the study. The section provided a literature review outlining the following emergent themes:

- Digital Divide (Section 2.1)
  In summary, lack of material access can cause a digital divide, due to resources limitation, age, and gender, as well as a lack of internet access, skills and digital literacy.
- Educational Strategy (Section 2.2)
  Strategies that prepare teachers play an important role in education. Challenges of teaching with technology also play an important role in how teachers deliver content to learners.
- Human Factors (Section 2.3)
  Learners who do online learning, study better using technology, compared to learners who are not willing to adapt to online learning.
- Government Support (Section 2.4)
  Lack of proper ICT infrastructures that support e-learning can hinder the implementation of real-time online learning. Furthermore, other issues include lack of constant supply of electricity, internet bandwidth, a lack of library facilities, and devices accessibility;
- Section 2.5 closed the chapter with the conceptual framework.

The next chapter will review the research design and methodology.

3 CHAPTER 3: DESIGN AND METHODOLOGY

The previous chapter reviewed the literature supporting this study, which included the Digital divide, Educational Strategy, Human Factor and Support Management, Information leakage, Information policy, and Policy compliance. Furthermore, Chapter 2 introduced the Conceptual Model. This chapter discusses the Research Design in Section 3.1, Methodology in Section 3.2 Ethical consideration in Section 3.3, and Summary in Section 3.4.

3.1 RESEARCH DESIGN PROCESS

Research design process is a map that is designed to archive research objectives. Research design focuses on the type of research – it gives direction to the study, the research process “onion” (Saunders, Lewis & Thornhill, 2016).

In Figure 3.1 below, the “onion” illustrates the variety of choices, paradigms, strategies and steps followed by researcher. The different layers of the onion serve as a basis from which to consider the following: the philosophical underpinnings; the research approach; appropriate research strategies, the methodological choice, the time horizon, and the techniques used for data collection.

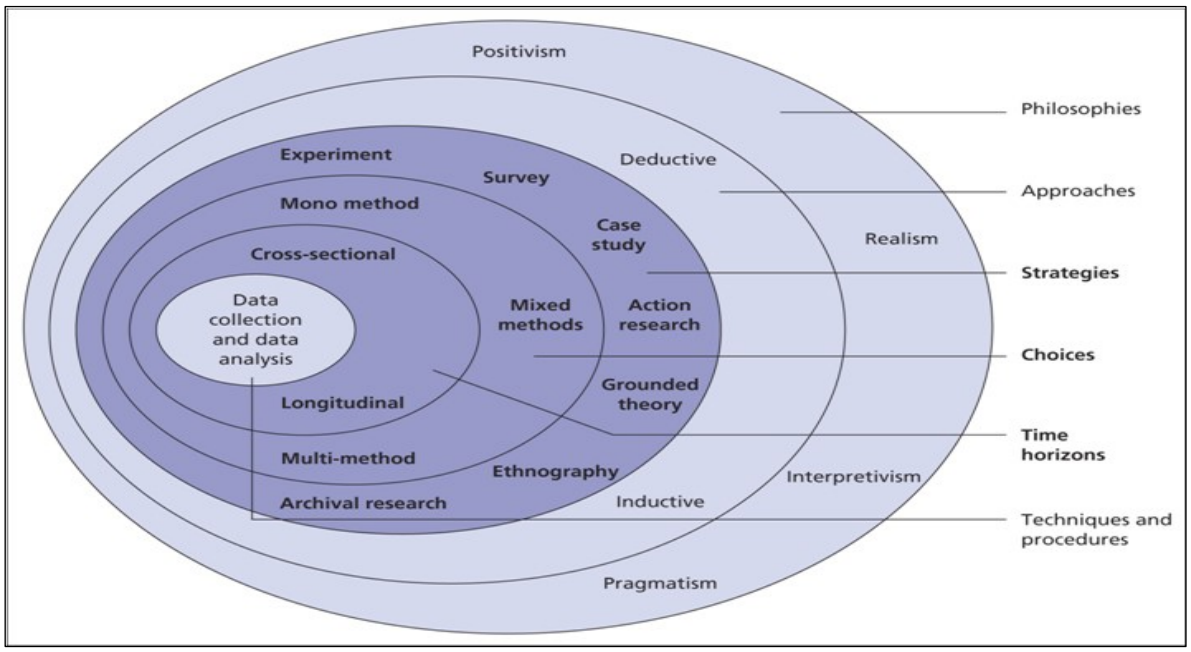

Figure 3.1 : The research "onion" (Saunders, et al., 2016)

3.1.1 PHILOSOPHICAL UNDERPINNINGS

In a research study, philosophy is important in forming the basis for each research and also to guide the researchers for the choice of the research strategy, how to construct the problem, data collection, data preparation and data analysis (Žukauskas, Vveinhardt & Andriukaitienė, 2018). Many different philosophies can be used for a better understanding. Let us look at three most-used philosophies, namely positivism, critical-realism, and interpretivism.

- Positivism: It reflects the philosophical deportment of a natural scientist. Knowledge is gained through observation and discovery of event regularities, which are constructed on fundamental law-like and functional relations.
- Critical-Realism: It is established on the following ontological assumptions: 1) the world involves real entities; 2) we observe the perceptions and images of real entities, but not the real entities themselves (Saunders, Lewis, & Thornhill, 2016). Knowledge is obtained through discovering generative mechanisms.

- Interpretivist: It is an approach that is based on subjectivist ontological assumptions that entities are established from discourse (Myers, 2011). Knowledge and facts are relative and subjective.

This study follows the interpretivist approach, that deals with participants' experiences, opinions, and points of view related to the subject of research (Klerk & Villiers, 2012). The design relies on the selected interpretive research paradigm, using a case study as an ideal strategy. This strategic choice is justified, as it focuses on real-life setting, which provides an understanding of the meaningful characteristics of the actual situation, such as people's lives and institutional and managerial processes (Almalki, Centre & Arabia, 2016).

Furthermore, Saunders et al. (2008) outline that an interpretive qualitative case study is an underlying principle in selecting appropriate cases as the reference for information-rich cases concerning the topic under investigation, resulting in the use of purposive sampling.

3.1.2 APPROACHES TO THEORY DEVELOPMENT

The choice of a research approach may vary from a deductive approach to an inductive approach (Kivunja & Kuyini, 2017). Drawing from the work of Levers (2013), the following two approaches are outlined:

3.1.2.1 DEDUCTIVE APPROACH

Deductive approach is the construction of theories and hypotheses by the researcher, prior to designing a research strategy as a means of testing an existing theory (Lee, 2016).

3.1.2.2 INDUCTIVE APPROACH

This approach aims at producing meanings from the collected data in order to identify patterns and relationships to build a theory (Scotland, 2012). An inductive perspective is based on learning from experience (Bhattacherjee, 2012).

This qualitative study adopts both approaches as the information will be chosen from the literature to develop the themes and then worked inductively as those themes became the platform for the imperial work as it expands from what has been done deductively, deductive because of the use of existing literature and inductive as more information gathered.

This research strategy is based on understanding and gathering in-depth information (Pietkiewicz, Jonathan & Smith, 2012) which produces thick and rich data (Idowu, 2016).

3.1.3 METHODOLOGICAL CHOICE

Research methodology is one of the main elements of a research study (Creswell, 2003). This section explains three different methodological choices:

- Qualitative methods
- Mixed methods
- Multi-methods

3.1.3.1 QUALITATIVE METHODS

Qualitative methods ask open-ended questions that allow the participants to respond freely in their own words. This leads to a more thick and rich response as opposed to a ‘yes’ or ‘no’ answer (Mack, Woodsong, Macqueen, et al.). Additionally, the analytical objective of the qualitative method is to pronounce the separate responses.

3.1.3.2 MIXED METHOD

Some authors have argued that there is an interrelation between qualitative and quantitative research methods (Creswell, 1999). In Section 3.1.4, the differences between the research methods are displayed – one of them being the differences in analysis. The analysis of the data obtained for this study was done by integrating quantitative and qualitative research analysis methods. Therefore, the research choice for this study cannot be mixed method as the research made use of qualitative methods.

3.1.3.3 MULTI-METHOD

To obtain deeper, more meaningful and reliable perspectives on a research topic, most researchers have recommended the use of multiple methodologies (Cyr, Larios & Head, 2009). Multi-method research will be used in a step-by-step process, using a literature review and interviews as part of the design of a case study (Lytra,Soberning & Zdun, 2012).

This study follows the qualitative multiple methods, and it uses observations, paper-based questionnaires and interviews as the methods of data collection. Data triangulation allows the process of using a different source of data collection, including different places and times (Wilson, 2014). Multiple methods gather more data as questions from paper-based interviews links with those questions of the semi structured interview, for the semi-structured interviews data will be recorded using the recording device and for the paper-based questionnaires questions will be handed to the participants. The researcher will collect data for each case from school principals, a selection of teachers and learners, and administrators who are willing to participate in the study.

3.1.4 STRATEGIES

The study employs a case study strategy, It conducts social science research (Yin, 1999). The benefit of using a case study is to gain an in-depth understanding of the phenomena of research. Yin (2002) suggests that although case study methodology does not present the researcher with well-defined protocol, it offers the opportunity to research social science-oriented contexts (Yazan, 2015). Consequently, these situations lend itself to a case study research approach. Yazan (2005) implies that this approach is well-situated for educational research. Many tools and techniques are of value. Drawing from the work of Yazan (2015), the research design logically connected to the research purpose and questions and to the process for empirical data collection and data analysis to conclude the data collected. The study followed a qualitative methodology where data will be collected via observation, paper-based questionnaires and semi-structured interviews (Saunders et al., 2016). Qualitative research was followed for this study as it provides a more realistic feel of the case that cannot be experienced in the numerical data and statistical analysis used in quantitative research (Yazan, 2015).

3.1.5 TIME HORIZONS

Time horizons are referred to as periods taken for the study to be completed. Kosow and Gaßner (2008) indicate three basic time horizons:

- Short-term – up to 10 years
- Medium-term – up to 25 years
- Long-term – more than 25 years

This study adopts a short-term time horizon as it does not require more than 10 years to explore guidelines that inform decisions regarding the implementation of real-time, online learning in a rural context of Limpopo, South Africa.

3.1.6 TECHNIQUES AND PROCUDURES

Determining the data-collection techniques and procedures is one of the strengths of the case study method, because of its flexibility and adaptability (Wilson, 2016). The techniques and procedures allow the use of single or multiple methods of data collection when investigating a research problem (Wilson, 2016). This study used techniques and procedures which included sampling, data collection, and data analysis techniques.

The participants were selected based on criteria such as their roles and responsibilities at the different schools. This included principals, teachers, administrators and learners, who provided their insights. These participants were the most representative people at the school who play key roles, the principals were selected as they are involved in the day-to-day running of school activities, teachers were selected because they are involved in presenting classes and they witnessed protests and flooding and the selection of Grade 11 and 12 learners was based in the fact that those are learners who have been in these schools for the past five years and who have experienced these challenges and therefore they were able to offer informative data.

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3.1.6.1 OBSERVATION

The researcher is a resident of the Lukalo region in Limpopo. He chose to explore the selected cases as he is familiar with highlighted educational challenges associated with the region. The Vuwani case was selected as it is not far from the researcher's residence. Additionally, he observed that although the schools are situated in the same region, differing challenges are experienced. One school is regarded more rural than the other.

3.1.6.2 SEMI-STRUCTURED INTERVIEWS

Sixteen (16) participants were purposively selected because only 16 were available for the process of semi-structured interviews and the researcher has travelled from far. Participants 1 to 8 are from Case A, Milton Mpfumedzeni Secondary School (MMSS). They are the key Case A representatives and include the principal, three teachers, three learners, and one administrator. Participants 9 to 16 are from John Mutheiwana Secondary School (JMSS). These are the key Case B representatives, also from the school principal to the learners. As a result, eight (8) participants were selected from MMSS and eight (8) participants from JMSS – a total of 18 participants.

3.1.6.3 PAPER-BASED QUESTIONNAIRES

Twenty (20) participants were purposively selected for because only 20 were available for the process of data collection through questionnaires and the researcher has travelled from far. Ten participants were selected for each case (Participants 1 to 10) – Case A MMSS, and Case B JMSS. They are the key Case A and B representatives, and they are all Grade 11 learners. As a result, 10 participants were selected from MMSS and 10 participants from JMSS, resulting in a total of 20 participants.

3.2 METHODOLOGY

3.2.1 DATA COLLECTION METHODS

For this study, the researcher has taken different approaches towards the studied object to provide a broader picture and that approach is called method triangulation (Höst & Runeson, 2007). Triangulation is alleged to be a strategy that is typical for improving the strength of research (Mathison, 2014). For data collection, each selected school had seven participants. The criteria for participants were position, role and responsibility assumed at these schools, different participants have different roles which is needed for this study. Principals understands the running of schools, teachers have the responsibilities to present quality education and learners are the most affected participants. As the researcher was already aware of Covid-19, the researcher through the help of school principals followed all the protocols that is social distancing, wearing of mask and the usage of sanitizer, both schools were already familiar with all the measures that needed to be taken to minimize the spread of Covid-19.

Table 3.1 presents the selected participants from each school.

Table 3.1: Selected school participants

Role	MMSS	JMSS	Total
Principal	1	1	2
Teachers	3	3	6
Administrator	0	0	0
Learners	3	3	6
	7	7	14

For this study the researcher used observations, paper-based questionnaires, and semi-structured interviews, as it allows the interviewee to explain and provide more

information based on the research phenomena (Braun & Clarke, 2013). Collected data were then analysed, together with the literature it was used as findings of the study. Interviews could be used as data collection tools (Obeid, Mcgraw & Minor, 2013). Semi-structured interviews were selected as they enabled the collection of thick and rich data, supporting the exploration and achievement of a deep understanding of emergent themes and concepts (Schultze & Avital, 2011).

3.2.1.1 RESEACHER'S OBSERVATIONS

Observation is a way in which data can be collected through observing human behaviour or a situation. It is categorized as a participatory study as the researcher had to engage himself in the location where the participants are, while taking notes through writing or recording (Paul, Qunin & Huijser, 2014). As the researcher is a resident of Lukalo, he has observed the educational challenges that affect schools in rural areas.

3.2.1.2 PAPER-BASED QUESTIONNAIRES

Paper-based questionnaires were used to question all the learners, for learners bellow the age of 18 a consent letter was obtained from their sponsor through the help of principals who played as gatekeepers. The interviews were conducted at the participants' schools. The paper-based questionnaires have both structured and unstructured features, with both closed and open questions. The Likert scale questionnaire was used on a scale of 1 to 4, where 1 represents strongly disagree and 4 represents strongly agree. This type of interview has also a set of pre-planned core questions for guidance, to cover the same area for each learner (Touvier, Méjean, Kesse-guyo, Malon & Hercberg, 2011).

3.2.1.3 SEMI-STRUCTURED INTERVIEWS

Semi-structured interview techniques were used to question all the participants, as they could express their views and opinions. Semi-structured interviews are a common data collection method in qualitative research, and the quality of the interview guide fundamentally influences the results of the study (O'Keeffe, Buytaert, Mijic, Brozovic,.

& Sinha, 2016). The interviews were conducted at the participants' schools. The semi-structured method has both structured and unstructured features, thus both closed and open questions were used. This type of interview has a set of pre-planned core questions for guidance, to cover the same area with each interviewee.

3.2.2 CASE STUDIES

This study used a case study strategy that provides a 'slice-in-time' platform and opportunity for the gathering of sufficient rich and thick data (Ishtiaq, 2019). Furthermore, Yin (1999) defines case as "a contemporary phenomenon within its real life context, especially when the boundaries between a phenomenon and context are not clear and the researcher has little control over the phenomenon and context" (p. 13). Yin (2002) further explained that a case study is an empirical inquiry that investigates the case or cases conforming to the abovementioned definition by addressing the 'how' or 'why' questions concerning the phenomenon of interest. This study is not a comparative case study that involves the analysing of similarities, differences and patterns across two or more cases (Yin & Merriam, 2015). However, it followed exploratory and condensed case studies, performed before implementing a large-scale investigation. Its basic function is to help identify questions and select types of measurement prior to the main investigation (Yin, 1999).

Two cases were implemented, namely Milton Mpfumedzeni Secondary School (MMSS), and John Mutheiwana Secondary School (JMSS).

3.2.2.1 DESCRIPTION OF THE CASES:

Case A: Milton Mpfumedzeni Secondary School (MMSS)

This school is classified as a rural education institution by The National Educational Infrastructure Management System with the national EMIS No: 930360962. The school had a ± 1049 learners and about 31 teachers. This school has been renovated and officially opened on 9 October 2012.

The school is located at Lukalo, a deep rural area of Limpopo Province, South Africa. This school has been previously affected by heavy rain and bad road conditions, which resulted in learners that were unable to regularly attend school and who missed classes. This case is chosen because of its educational challenges during the heavy rains, when learners are not able to attend school. Regardless of these challenges, it still produces good results.

Case B: John Mutheiwana Secondary School (JMSS)

This school is a nonselective school, which means that students are not admitted based on any criteria. Its national EMIS No is: 930321226 and it is located at Vuwani, Vhembe District Municipality, Limpopo Province, South Africa. The school had ± 19 teachers and about 384 learners as of the year 2020. It was built in 1899. This school has been previously affected by service-delivery protests which resulted in learners being unable to attend school regularly and missing classes for about three months. This case is chosen based upon the protest challenges that have negatively affected school attendance over the past few years and which has regardless of all those challenges, still managed to produce good results.

3.2.3 UNIT OF ANALYSIS

This study focuses on analysing findings from the principal, teachers, administrators and learners from two cases, and reports the findings from individuals. Two schools were selected, namely Milton Mpfumedzeni Secondary School (MMSS) and John Mutheiwana Secondary School (JMSS).

Table 3.2 presents the selected schools as the main units and the place of operation.

Table 3.2: Unit of analysis per school

Schools	Role	Place of Operation
Case A MMSS	Principal	Lukalo, Limpopo, South Africa
	Teacher	
	Administrator	
	Learners	
Case B JMSS	Principal	Vuwani, Limpopo, South Africa
	Teacher	
	Administrator	
	Learners	

3.2.4 POPULATION AND SAMPLING

This research study used non-probability sampling, because it is the preferred method for qualitative studies (Mujere, 2016), as it uses a non-numerical method of generalization (Yin, 2011). The purpose of a sampling technique is to reduce the workload that is taken to complete the work (Draugalis & Plaza, 2009).In simple random sampling, every participant from the selected school had an equal opportunity to be selected and to participate in the sample. This sampling process was undertaken in an unbiased manner (Creswell, 2014).

Yin (2012) indicates the language of sampling suggests a desire to accomplish analytical generalizability. Purposive sampling, also known as selective sampling, is a non-probability sampling. In non-probability sampling, researcher judgment and convenience guide the selection of case units. This study includes two samples. One sample represents Case A, while the second sample relates to Case B. Both samples are participant sampling, which are convenient, purposive, and non-probabilistic (Tongco & Dolores, 2007).

Table 3.3 presents the selected participants from the school.

Table 3.3: Actual Sampling

Level	Role	MMSS	JMSS	Total
Staff	Principal	1	1	2
	Teacher	3	3	6
	Administrator	1	1	2
Learners	Learners (Grade 12)	3	3	6
	Learners (Grade 11)	10	10	20

3.2.5 QUALITATIVE DATA ANALYSIS

Data analysis refers to the process of systematically applying statical or logical techniques, organizing the emergent data to break into manageable chunks that can be encoded (Drahošová, Balco, Kubičko & Drahošová, 2018).

Qualitative data has the purpose to discover concepts, themes, and meanings. For the purpose of this study, the interviews were recorded and transcribed so that the researcher could analyse and describe the data for each participant separately. The interview responses were compared and categorized. The researcher has endeavoured to achieve triangulation by using multiple sources of data, leading to rigor via rich and thick outcomes (Jin, Wah, Cheng & Wang, 2015).

The collected data was determined by responses from participants at two different schools. Additionally, the researcher has differentiated feedback between teachers and learners. The interpretive analysis is the approach that is devoted to capturing the uniqueness of events (Yin, 2011). It focuses on the words of the participants (Braun & Clarke, 2013). This approach guides understanding for the interpretation of this research project namely, real-time online learning systems in a given person and context, by trying to make sense of the topic. Various types of codes can be used to

label segments (Bradley et al., 2007). A coding scheme that lists all the codes that were identified was used to get an overall perspective of the codes, from the literature the researcher locked at the key words and from the key words he then find the duplicates and merge them into codes and nodes, new key words also emerged.

Following transcriptions of the semi-structured interview methods recording, a careful reading of the transcript was performed (Campbell, Quincy, Osserman, Jordan & Pedersen, 2013). Through reading, the intent was to grasp initial thoughts on the themes that emerge from the transcript. Additionally, this was done iteratively to understand and precisely determine the dominant themes.

The tool called *Atlas.ti* was used to generate all similar codes and group them together, as it provides very useful tools in academic research, particularly for social science disciplines (Hwang, 2008). *Atlas.ti* include describing criteria such as positions, roles, and responsibilities that were assumed in the schools. The intention was to provide a better understanding of the dynamic of responses given by each research participant. Codes were derived from the themes, concepts, and ideas created from the data. Also, codes were guided by the modalities of the duality of structure theory that served to conceptualize the research problem. The word or group of words that related to the themes were identified in the problem conceptualization, including any new themes that emerged from the data.

The data guided the development of themes. The underpinning theory played an important role by identifying the themes. According to this theory, themes were categorized using the modalities of the duality of structure such as interpretive schemes, norms, and facilities.

After a careful reading, a total of five (5) categories emerged from the codes, the interview data, questions in the interview, and common-sense constructs. These categories led to themes and only one (1) additional theme emerged. These themes were also derived from common sense constructs and a theoretical understanding of the phenomenon (Ryan & Bernard, 2003).

Table 3.4 presents the summary of categories and themes that emerged from the literature and from both the selected schools. Additionally, an emergent theme was extricated.

Table 3.4: Summary of themes

Literature-Based Themes	Emergent Theme
Digital divide Educational strategy Human factors Government support	Affordances

For the purpose of this study, thematic analysis was chosen for analysing the observation and information obtained from the interviews about the selected cases, the study work from the literature, the literature forms the foundation of the themes, see concept model figurer 2.1, from those themes data was analysed in themes. The process included the analysis of the obtained information and the creation of categories as the researcher was observing, understanding and rewriting the information into text. Thereafter, it was subjected to qualitative content analysis where designs and themes were identified from the information obtained (Wahyuni, 2012). Inductive content analysis is an analysis of qualitative data by splitting data into small chunks that allow for sense-making (Hsieh & Shannon, 2005).

The following process was used during qualitative, inductive, content analysis (Elo & Kyngäs, 2008):

- Information transcription from audio into the written text.
- Putting together information to analyze and define the unit of analysis for the process.
- Development of categories and units of analysis orders (this was done inductively from the information obtained).
- Analyzing all units.
- Evaluating units of analysis.

- Concluding the analyzed information.
- Reporting on the analyzed information.

Interpretive analysis is an experiential analytical method that focuses on the words of the participants (Braun & Clarke, 2013). It aims to provide an understanding of a given person and context by making sense of a given phenomenon (Braun & Clark, 2013). The interpretive analysis also focuses on a participant's experience, which has implications for how an individual identifies within a specific context (Pietkiewicz & Jonathan & Smith, 2012).

For this study, the interpretive analysis was followed to gain an understanding of what factors prevents and which influence a real-time online learning system in two specific rural areas in Limpopo in South Africa. Interpretive analysis is concerned with interpreting the meaning of the authentic experiences of the participants of the selected schools or cases.

The researcher set aside his prejudgments, perception, imagination, and other general structures to get an insider's viewpoint (Pietkiewicz, Jonathan & Smith, 2012).

For the purpose of this study, the interpretive analysis proposed by Liu (2016) included:

- Transcription of the data
- Reading and understanding of the data
- Writing down the information
- Developing emergent themes
- Identifying the connections across emergent themes
- Interpretation of the data

3.2.6 DATA QUALITY ASSURANCE

According to Saunders et al. (2008), data quality must follow a quality standard, validity, and reliability. For the purpose of this study data quality was taken into consideration by following a detailed procedure during data collection. The researcher made sure to monitor and evaluate the process in the field, and he identified the areas that needed improvement to ensure that the data was valid and reliable.

3.2.6.1 DATA VALIDITY

Data validity is followed as an indication of how sound the research study is (John & Miller, 2000). The interview questions were accurately measured. The title, aim, summary, and themes of the study were sent via email to the participants a few days before the interview to enable them to be prepared by obtaining the supportive documents.

The following steps were taken to ensure the validity of the collected data:

- Data was collected in both cases, from John Mutheiwana Secondary School (case A) and from Milton Mpfumedzeni Secondary School (Case B).
- The researcher looked at the existing literature foundation for the study.
- The interview date and time were selected to make sure that procedures did not influence the data collection process.
- Interview questions were both pre-tested and pilot-tested before the in-depth interviews with the participants were conducted.
- A pilot study was exercised, as it aimed to improve the rigour of the research (Nunus, Martins, Zhou, Alajamy & Maram, 2010) by achieving validity and verifiability of the questionnaire as an instrument.
- The pilot study exercises improved the quality, reliability and validity of this research (Cohen, Manion & Morison., 2009).

3.2.6.2 PRE-TEST

The pre-test phase addresses issues that need to be resolved before the data collection process (Stake, 2001). Pre-test interviews were carried out with the former learners from Milton Mpfumedzeni Secondary School who are now studying in Cape Town. During the pre-test, those learners indicated that the interpretations of some terms were not clear enough, and that participants might interpret them differently. The idea was to make sure that the list of designed interview questions was correctly interpreted by the participants. This helped the researcher to eliminate some possible problems related to the interview questions and the way the interviews should be conducted.

3.2.6.3 PILOT-TEST

After finishing with the pre-test phase, a pilot study was performed by circulating a round of questions to other master's students. The researcher asked the participants to provide brief comments based on the interview. The participants confirmed that the questions were appropriate and that the correct data would be captured. A few adjustments were made to the interview questions – questions were reduced from the initial 35 to 21 for the final arrangement.

3.2.7 DATA TRUSTWORTHINESS

This study ensured the trustworthiness of the data to determine the validity and reliability of the results (Lincoln & Guba, 1985). The following four termed criteria were identified as a contribution to the trustworthiness of this study:

- Credibility
- Transferability
- Dependability
- Confirmability

3.2.7.1 Credibility

Triangulation is a technique that contributes to the credibility of a study (Lincoln & Guba, 1985), therefore it was followed. Three measurements were used in the same landscape to be effective. Triangulation is mostly used in social research by referring to the observation using more than two points of the researcher's perspective (Flick, 2004). Triangulation can also be used between methods which could include surveys or semi-structured interviews (Farquhar & Michels, 2016). During this study participants were divided into four different levels as indicated in Table 3.3. Observation, paper-based interviews, and semi-structured interviews were used to collect data and they will be presented in the next chapter.

3.2.7.2 Transferability

To ensure that similarity judgments were achieved, all original data was maintained and also presented as a thick description (Casey & Murphy, 2009). For this study transferability was presented by how thick and rich the data was and how other researchers could apply it in similar contexts (Lincoln & Guba, 1985). Detailed explanations of case study outcomes during qualitative data analysis, allowed measuring the extent to which resonance and analytical generalisation (Yin, 2012) made it possible to draw the conclusion from the emergent themes.

3.2.7.3 Dependability

According to Lincoln and Guba (1985), dependability refers to a judgment made by a proficient auditor who determines whether an audit trail exists. The person auditing without any knowledge of this study, should be able to indicate that all correct procedures were followed. Because this study is an independent study, the researcher has not shared it with any auditor.

3.2.7.4 Conformability

Conformability is established through reviews of the research process and findings (Lincoln & Guba, 1985). To ensure data reliability and conformability of this research study, a full description of the participants was made available on a compact disc (CD), USB, external hard drive and cloud storage, which contain the recorded interviews. This focussed more on the cases of data and reconstructions (Lincoln & Guba, 1985).

3.3 ETHICAL CONSIDERATION

Participation in this research study was voluntary, and participants were made aware that they are free to withdraw from the study without any consequences. All participants were asked for their consent, for learners under the age 18, consent letter was sent to their sponsor for consent on behalf of those learner before taking part in the study. The research study did not involve any processes that could cause harm to the participants or the environment; all the participants were treated with respect and integrity. According to Babbie and Mouton (2010), ethical consideration of research is recommended to ensure the confidentiality and anonymity of participants during the research period. To this effect, an ethical clearance letter was obtained from the CPUT's ethics review committee and permission from the LDE was provided for the data collection.

3.3.1 ETHICS AND CONSENT

For this research project, the research fully complied with the ethical principles of the Limpopo Department of Education (LDE). The approval letter from the LDE was provided to all the schools, following the general principles for scientific research precisely during the process of data collection, data analysis, interpretation, and the researcher ensured that confidentiality was enforced.

The research participants were selected fairly and unbiased in the selected schools. The participants were informed about the research study and asked to provide their approval before becoming part of the research. This research study assured the

confidentiality and integrity of the participants by making sure that their privacy was protected and that no harm was done to them. For instance, Carr (2010) argues that the ethical consideration of research is based on the confidentiality and anonymity of the participants. This research, therefore, presented only anonymized data, generally in a summarized form. This ensured that the benefits easily outweighed the risks, which is a common concern when considering ethical dilemmas. An ethical clearance letter was obtained from the University's ethics review committee to conduct the data collection. Thereafter, an informed consent letter requesting permission to collect data was sent to the participants. The consent letter also clarified that the participants may withdraw voluntarily at any time without giving reasons.

3.3.2 CONFIDENTIALITY

To protect the rights and identity of the participants, pseudonyms were used for anonymity and confidentiality. The researcher explained to the participants that the requested information was needed for academic purposes such as thesis, articles, and conferences, and could not be used against them or for any financial gain. However, the information obtained could be useful to the affected schools for the recommendation of a developmental framework of factors for the implementation of e-learning technology.

3.4 DELIMITATION

This study explored the factors underpinning the implementation of e-learning technology in rural areas. It will only include participants from MMSS and JMSS. This study will not implement RTOLs.

3.5 SUMMARY

This chapter outlined the research design section followed by the research methodology section, which explains how the planned design was carried out. This study adopted interpretivism as a research philosophy and qualitative methods will be used to archive the study's objectives. This unit also looked at the population sampling

and units of analysis. The interviews and observations were conducted and the ethical clearance to conduct research was attained. The following chapter will present the results, data analysis and findings.

4 CHAPTER 4: DATA ANALYSIS, RESULTS, AND FINDINGS

4.1 INTRODUCTION

Chapter 3 presented the research design and methodology for the study. This chapter focusses on the analysis results and the findings.

For this study data was collected using observation, paper-based questionnaires and semi-structured interviews. Interviews were conducted with principals, teachers and learners from two cases, Case A and Case B. The participants were:

- Principals (P1CA)
- Principals (P1CB)
- Teachers (T1CA, T2CA, T3CA)
- Teachers (T1CB, T2CB, T3CB)
- Learners (L1CA, L2CA, L3CA)
- Learners L1CB, L2CB, L3CB)

This section reviews a selection of themes that emerged during the interview process with the participants. The following five themes will be discussed:

- Digital divide
- Educational strategy
- Human factor
- Support
- Affordances

These themes ultimately led to the synthesis of hindrances and facilitators of real-time online learning.

Figure 4.24 at the end of the section summarises the themes.

4.2 DIGITAL DIVIDE

This section reviews a selection of codes that emerged from the digital divide as a theme. Section 4.2.1 addresses digital communication; Section 4.2.2 reviews digital knowledge and skills; Section 4.2.3 discusses the need for training; Section 4.2.4 discusses computer experience; Section 4.2.5 outlines network constraints; Section 4.2.6 addresses Internet access at school/home; and Section 4.2.7 explores preparedness.

4.2.1 DIGITAL COMMUNICATION

Communication is important for both teachers and learners to keep in touch regarding educational information. Participants were asked to comment on how they communicate after school or during school holidays. They indicated using SMSs, WhatsApp, or phone calls as a way of communicating.

Similar to what was found in literature in chapter 2,there is no proper digital educational communication channel that is used for communication between learners, teachers, and principals, however, SMSs or WhatsApp is used as a means of communication. This statement is supported by a learner who suggested stakeholders should "use free SMS from Vodacom" [L1CA].

There is also evidence that indicates that phone calls are also used as a way of communication. One learner [L2CA] said that he used his mother's phone to make phone calls. However, some learners use either SMSs, WhatsApp, or phone calls. This is supported by a learner [L3CA] who commented, "Usually, I use a cell phone for phone calls, WhatsApp or SMS for communicating with teachers". Additionally, one teacher [T1CA] from Case A indicated, "I use a phone call or WhatsApp" as his way of communication.

Phone calls seem to be the most convenient means of communication as they are also supported by Case A school principal [P1CA] who said, "we currently use a cell phone, just marking phone calls".

For Case B there is only one learner who indicated the possibilities of communication. This is evident in her comment saying: “We use WhatsApp or phone calls” [L1CB]. However, the principal for Case B [P1CB] indicated that he uses a cell phone as a way of communicating with his staff members.

> *Fortunately, as the staff, we have created a WhatsApp group so I normally* communicate with my educators using WhatsApp after school hours.

There is some evidence that shows that there is no communication that takes place among some teachers and learners. Two teachers from the same case indicated that there is no communication at all. One teacher [T1CA] commented: “There is no communication, because I can't give them my cell phone number” [T2CA]. Furthermore, the second teacher [T3CA] added: “We don't communicate”.

There is a serious challenge with digital communication for educational purpose in Case B. This evidence is supported by L2CB who said, “there is no communication at all, it is difficult to communicate”.

Evidence from one teacher [T1CB] indicates some difficulties in communication. Additionally, the second teacher [T2CB] said: “We don't communicate, mm …, we do not have communication with our learners once they are at home”. Furthermore, the third teacher from Case B also said that there is no proper communication.

The above comments are justified by results from the paper-based questionnaires as indicated in Figures 4.1 and 4.2. The majority of participants specified that there is no organized educational digital communication system. However, they mostly rely on WhatsApp.

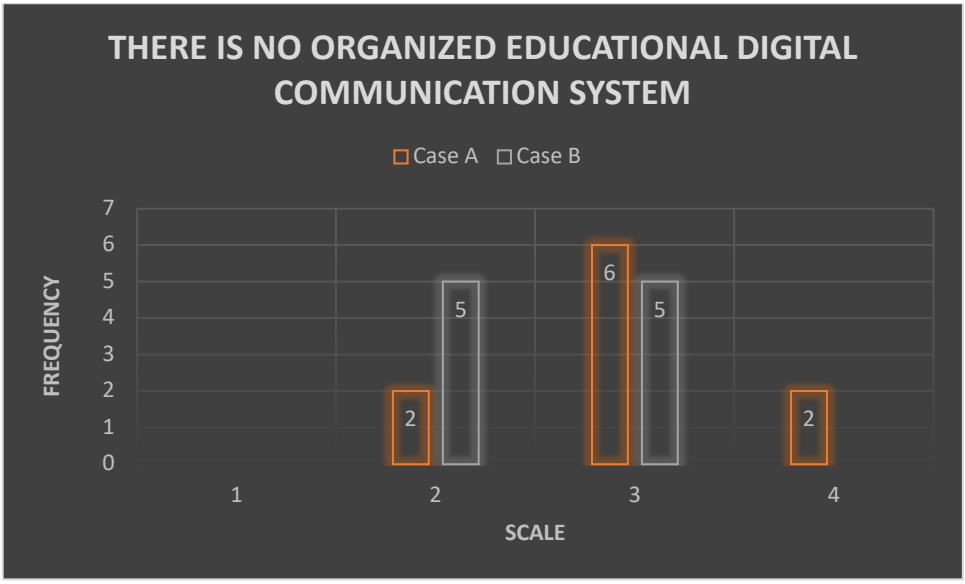

Figure 4.1: Digital communication

The graphs above illustrate the responses from the learners regarding a question about their method of communication. Most learners rated it as a 4 on the scale of 1 to 4, where 1 represents strongly disagree and 4 represents strongly agree. This question can be found in Questionnaire A, Question 4 (Q4) in Appendix F.

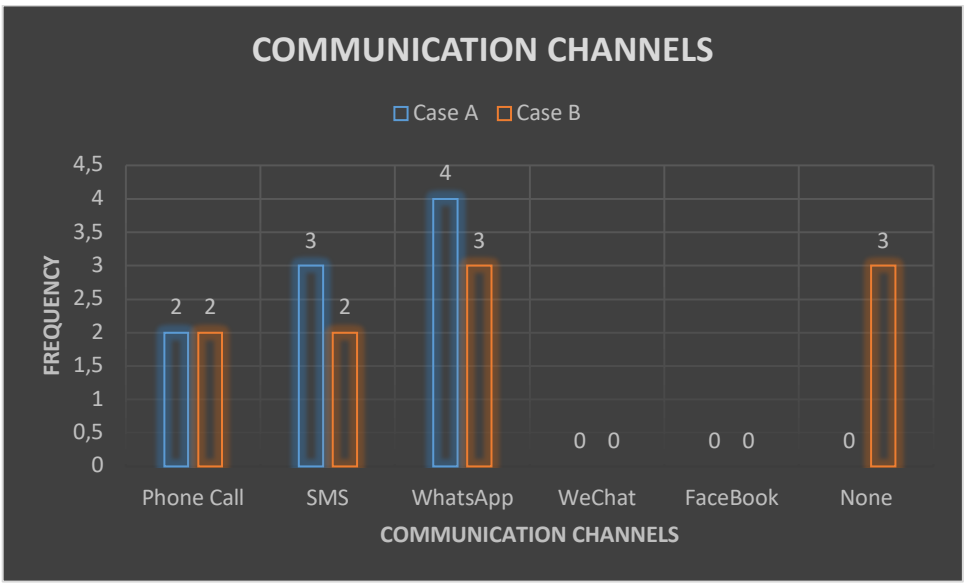

Figure 4.2: Communication channels

The graphs above illustrate the responses from the learners regarding a question about their channel of communication. The majority of learners chose WhatsApp from the different communication channels. This question can be found in Questionnaire A, Question 5(Q5) in Appendix F, the lack of proper digital communication channel from participants report shows that majority of people in rural areas currently do not have access to internet as indicated in the literature review, The first important concern is who has access currently and who does not have access to the internet (Bray, 2016);

4.2.2 DIGITAL KNOWLEDGE AND SKILL

For anyone to be able to use any digital system successfully, one would be expected to have some knowledge and skills.

Participants were asked to comment on their level of digital knowledge, and their responses show that most participants are knowledgeable and have been using digital platforms.

These days, everyone should have digital knowledge, because almost everyone can use a smartphone. This evidence is supported by a learner's comment saying: "According to me, I think anyone can be able to use it, because nowadays everyone is having a smartphone" [L1CA].

Several participants highlighted a lack of digital knowledge and feel that there is a need for more knowledge. This observation is supported by one learner who suggested a need for more digital knowledge [L2CA]. Furthermore, L3CA also believe that there is a need for more digital knowledge, since they are in a deep rural area:

> *I think we need a lot of digital knowledge since we are in a rural area and there is a lack of digital knowledge.*

Teachers from Case A share the same views concerning the lack of digital knowledge and suggested that there must be some sort of training. This is supported by comments from one teacher: "I feel that there is a need for that much knowledge" [T1CA]. T2CA

also felt that learners, teachers, and principals need some training, Furthermore, T3CA highlighted that learners and teachers need a lot of training, because technology always changes. Moreover, the principal [P1CA] for Case A also believes that there is a need for more digital knowledge.

On the other hand, some teachers believe that not much knowledge is needed. T1CB remarked: “Not too much knowledge is needed. The only thing that is needed is to know how to connect and how to use it. If you can connect and able to use, another training is personal”. Furthermore, the principal [P1CB] from Case B feels that they are knowledgeable. However, L1CB, L2CB, L3CB from Case B highlighted the lack of digital knowledge and indicated that they need more digital knowledge.

There is a need for proper training. This is also supported by T2CB who commented: “I understand that both teachers and learners might have prior digital knowledge, but it is important that we as teachers and learners should get the proper training to allow us to be able to use such a system freely”. Furthermore, the third teacher [T3CB] also indicated the need for digital knowledge:

> *I think we need more digital knowledge.*

There is enough evidence that the majority of participants are digitally incompetent and they would like to have further training.

Several participants highlighted a moderate level of digital skills. For example, one teacher [T1CA] commented:

> *Nowadays everyone is having a smartphone. It is very rare to find someone with no smartphone so the smartphone and tablets are the same.*

Furthermore, another teacher from Case B, [T2CB] commented:

> *I think I am good, but you see technology is always changing.*

Once more the third teacher [T3CA] indicated that one cannot have enough digital skills:

> *Well it is not bad but you can never be enough with technology, I did a diploma in computer in 2001, but I feel that there is a need to learn more. I understand computers, I use computers a lot when it comes to teaching, although I experience challenges like virus and storage backup because I took the time to gather all this information, and losing it is too simple.*

On the other hand, a teacher [T1CB] from Case B feels that you just need to know how to operate a computer:

> *The basic computer skill, not intense things, just to know how to operate and know how to communicate with a learner from a distance.*

Furthermore, another teacher [T2CB] from Case B, indicated that he has enough digital skills:

> *As I have said, I use it to project my lessons. I use power points and some PDFs to conduct my lessons, so I think there is a need for some more training.*

However, one teacher [T3CB] from Case B indicated that he does have digital skills :

> *we do not have much digital skills*

The above comments are justified by results from the paper-based questionnaires as seen in Figure 4.3. Most participants specified that they have less digital knowledge and skills that could be sufficient for them to use RTOLs.

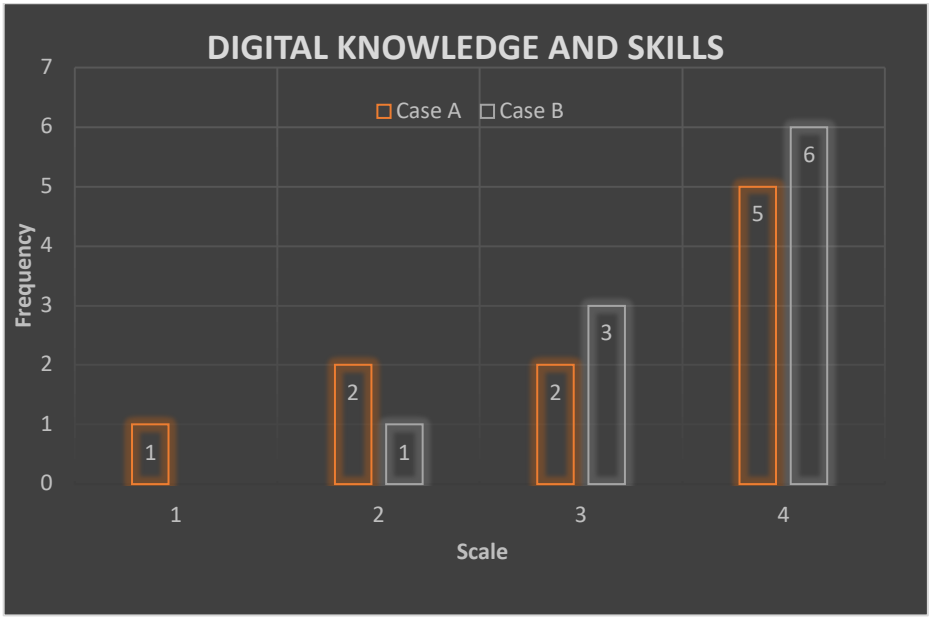

Figure 4.3: Level of digital knowledge and skills

The graph above illustrates the responses from the learners regarding a question about their level of digital knowledge and skills. The majority of learners for both Case A and Case B rated it as a 4 on the scale of 1 to 4, where 1 represents strongly disagree and 4 represents strongly agree This question can be found in Questionnaire A, question 6 (Q6) in Appendix F.

4.2.3 A NEED FOR TRAINING

For every individual to be able to successfully use digital devices, there is a need for training, as one teacher highlighted: “Some learners feel that they need training before they can start using it” [T1CA]. Another teacher also disclosed: **“**I think teachers must be trained on how to use new technology” [T2CA]. Furthermore, another teacher [T3CA] thinks teachers and learners need training on how to use the equipment and also how to access the system. The principal [P1CA] also thinks teachers will need proper training.

On the other hand, one teacher in Case B commented: “Teachers must be trained to be computer literate. Teachers should also be trained about the application itself (RTOLs)” [T1CA]. Two other teachers also feel the same way as they commented: “For

us as teachers, we need to have a workshop" [T2CB, L3CB]. Additionally, all this evidence from Case B is also supported by the principal who feels that "they need basic training on how to utilize the system in terms of RTOLs" [P1CB].

The above comments are justified by results from the paper-based questionnaires as seen in Figure 4.4. Most participants specified that they need digital training to be able to use e-learning technology.

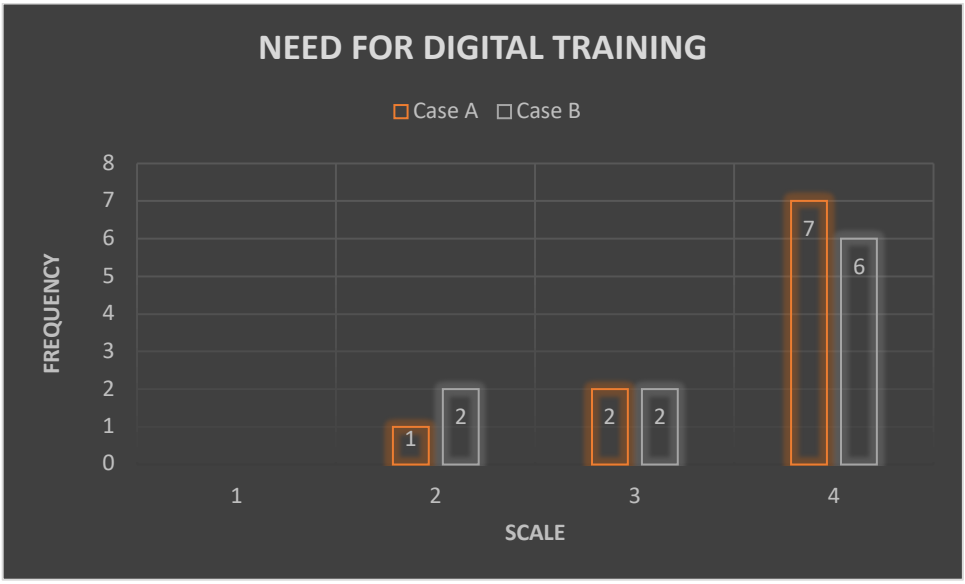

Figure 4.4: Need for digital training

The graph above illustrates the responses from the learners regarding a question if they need digital training. The majority of learners for both Case A and Case B rated it as a 4 on the scale of 1 to 4, where 1 represents strongly disagree and 4 represents strongly agree. This question can be found in Questionnaire A, question 7 (Q7) in Appendix F.

4.2.4 COMPUTER EXPERIENCE

Participants were requested to comment on their level of computer experience – whether they have used computers before and what it was like. Almost all participants indicated that they have had good computer experience. For example, L1CA commented:

It was good but my performance (school wise) was poor because I usually use it for fun stuff.

L2CA commented:

Eish, it feels good because as youth we are more addicted to gadgets, so using a computer or other mobile devices to learn feels great, and it also helps and encourages.

L3CA commented:

It is very good because everyone seems excited about the usage of computers.

Furthermore, also learners from Case B [L1CB, L2CB] indicated that they have used computers before.

L3CB commented:

Yes, I always use computers.

The above comments are justified by results from the paper-based questionnaires as seen in Figure 4.5. The majority of participants specified that they have computer experience.

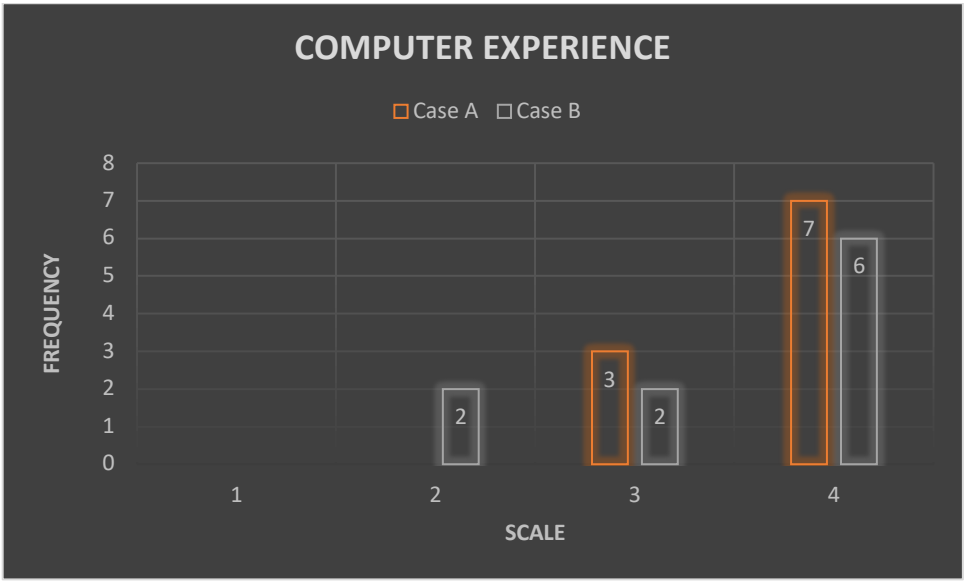

Figure 4.5: Computer experience

The graph above illustrates the responses from the learners regarding the statement: I have computer experience that might be needed for e-learning. The majority of learners for both Case A and Case B – even though Case B learners do not have computer lab evidence – revealed that they have used computers before. Most learners rated it as a 4 on the scale of 1 to 4, few rated it as a 3 and, and none rated it as 1, where 1 represents strongly disagree and 4 represents strongly agree, response from participants slightly differ with the evidence from the literature which indicates that there are limited skills and digital literacy in low-income communities, due to lack of access to devices and infrastructures (Handley, 2018). This question can be found in Questionnaire A, question 8 (Q8) in Appendix F.

4.2.5 NETWORK CONSTRAINTS

For any digital learning to take place successfully, there is a need for stable network connections and infrastructures that will sustain. According to one learner, the issue of theft can result in an infrastructures shortcoming: “Here there is a story of stealing; the gadgets might get stolen while you are sleeping, or you can get robbed and stuff. I am concerned about the safety of the devices” [L1CA]. However, another learner feels network connectivity will be an issue: “Looking at our area I think the network would be

the biggest limitation, because in our area we have network connectivity issues" [L2CA]. Furthermore, one other learner [L3CA] also shares the same view that the biggest limitation would be a network connection. However, it seems as if there are more limitations besides those indicated by learners, as one teacher [T1CA] mentioned the availability of materials. Furthermore, the second teacher added: "Availability of gadgets to all learners and teachers. I think that could be the limitation, and also network coverage will be a problem" [T2CA]. Additionally, the third teacher strongly believes that the network will be the main limitation: "If you try to make a WhatsApp call you will find it freezing a lot" [T3CA].

All the evidence provided by learners and teachers is supported by the additional comment from the principal: "Limitation would be more of a network connectivity issue" [P1CA].

Most rural communities do not even know what a library is, let alone what its function is (Campana, Mills, Janet, Capps & Cherly., 2016).However, all learners from Case B believe that they do not see the network as a constraint or limitation: "The network is fine where I come from" [L1CB, L2CB, L3CB]. All the evidence from learners from Case B slightly differ from how the teachers think. One teacher said: "In terms of network connection, we do not have enough network connectivity here" [T1CB]. Two more teachers also added: "Network tower would be a problem, especially if it gets vandalized during the protest" [T2CB, T3CB]. The principal also shares the teachers' view and that also relates to that of learners: "Especially network connectivity in some areas, maybe the problem of networks, but sometimes not always" [P1CB].

The above comments are justified by results from the paper-based questionnaires as seen in Figure 4.6. Many participants from Case A specified that there is no stable internet connection.

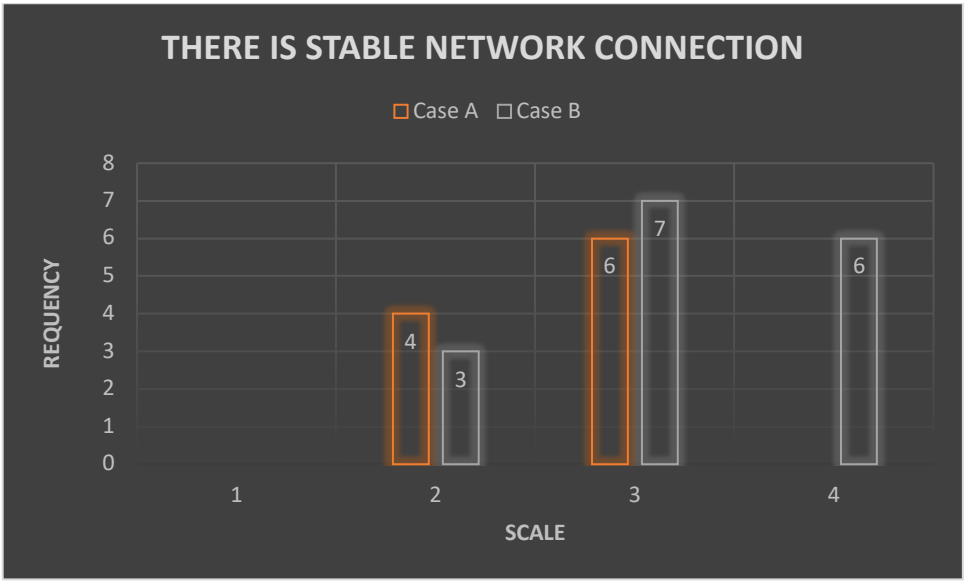

Figure 4.6: The is stable network connection

The graph above illustrates the responses from the learners regarding a statement: There is stable network connection that can enable RTOLs. The majority of learners for both Case A and Case B agreed. However, Case B participants indicated that even though sometimes they also experience network issues it is not always. Most learners rated it as a 3 on the scale of 1 to 4, few rated it as 2 and none rated it as 1, where 1 represents strongly disagree and 4 represents strongly agree. This question can be found in Questionnaire A, question 8 (Q8) in Appendix F.

4.2.6 INTERNET ACCESS AT SCHOOL OR HOME

Participants were asked to comment on how they access network connections. The evidence indicates that most participants buy data for themselves when they are at home. All learners [L1CA, L2CA, and L3CA] said they buy data bundles.

When asked to comment on how learners access the internet, teachers responded by saying: “Here at school we have a computer lab, and at home they use their phones and buy their data, and some use their modems. I have my Wi-Fi router” [T1CA]. However, the second teacher [T2CA] believes that learners have smartphones that they use to connect. Additionally, the third teacher thinks that learners use the lab at

school: “There is a dish here at school and there is a computer lab, but hey, this network is very slow and even my phone is much better, but anyway there is a computer lab here, but at home I believe that they are buying data” [T3CB]. Furthermore, the principal from Case A also indicated that they use the school lab and also buy their data: “We have a computer lab that learners and teachers use. Teachers also have computers in their office, and I also believe that teachers have their routers and learners buy data and use their phones” [P1CA].

The access to the internet is completely different for Case B, as they do not allow learners to have a phone at school, but at home they use their phones.

Two learners indicated that there is a dish connected, but it does not work, and at home they do not have phones [L1CB, L2CB]. However, one learner uses her father’s phone for educational research: ”I use my father’s phone” [L3CB]. The evidence that cell phones are not allowed is supported by one teacher’s comment when saying: “Here at school we don’t allow cell phones. At home I believe they buy their own data” [T1CB]. Two more teachers also commented:” They can’t do research here at school, we do not allow gadgets” [T2CB, T3CB]. Lastly, the principal from Case B commented: “They use their Wi-Fi. Here at school the school buy data, we make use of the school funds. And for myself, I buy my data. If I do not buy data, I am offline and I will miss the WhatsApp group chats that discuss academic issues” [P1CB].

The above comments are justified by results from the paper-based questionnaires as seen in Figure 4.7. The majority of participants from both Case A and Case B specified that there is enough internet access either at home or at school, however information from the literature suggests that internet access remains a serious issue in older populations (Media & Friemel, 2015).

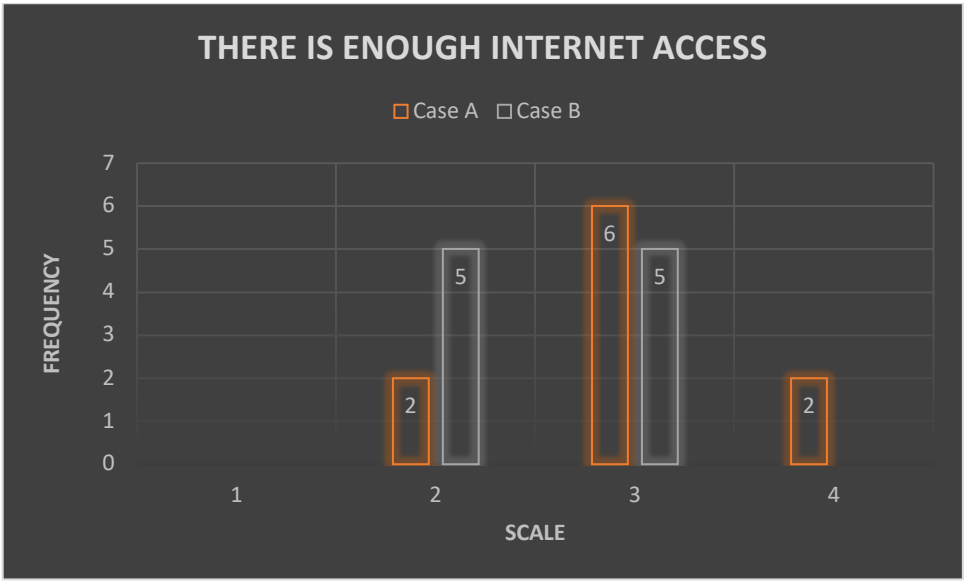

Figure 4.7: Internet access from home or school

The graph above illustrates the responses from the learners regarding the statement: There is enough internet access. Even though the majority of learners for both Case A and Case B use different methods to gain internet access, most learners rated it as a 4 on the scale of 1 to 4, few rated it as a 3 and others rated it as a 2, where 1 represents strongly disagree and 4 represents strongly agree. This question can be found in Questionnaire A, question 9 (Q9) in Appendix F.

4.2.7 PREPAREDNESS

There is a need for one to prepare before any academic class. It can be a normal class, project, or an assignment. According to the information from the literature digital knowledge also enables people to create and share knowledge through social networks, and it gives them the ability to support an extensive range of specialized computing skills (Martin & Grudziecki, 2015). Participants were asked how they prepared. Some indicated that they prepare using books. One learner-participant said: ”I just ask people around” [L1CA]. However, another learner [L2CA] indicated that he prepares using the internet: “I use phones from home and when I am here at school, I use school lab to do research”. Another learner commented that he depends on his uncle’s phone [L3CA]. Interestingly, one teacher from Case A indicated that he did not

like using computers for school research. He commented:" I use textbooks" [T1CA]. Two teachers indicated that they use the computer and internet to visit some sites and also access YouTube to learn about some topics [T2CA, T3CA]. The principal commented:

> *They usually use their cell phones and buy data, but here at school they use the computer lab, although it sometimes has some connectivity issues" [P1CA].*

On the other hand, the majority of participants from Case B also rely on the internet to prepare their school work. For example, L1CB commented: "I use the internet on my phone", and two learners indicated that they ask their relatives for phones to do some school work [L2CB, L3CB]. Furthermore, all teachers from Case A use the internet to do research and to prepare. This is supported by their comments: "My phone I use Google, I use the internet a lot to do my research and prepare for my lessons. I use what we call pacesetter that helps to indicate the schedule as to what to focus on for each term" [T1CB, T2CB, T3CB]. According to the principle, some of them do use Google [P1CB].

4.2.8 DIGITAL DIVIDE: CONCRETISATION

Figure 4.8 below summarises the theme: Digital divide and all its emergent sub-themes. The sub-themes are: Digital communication, Digital knowledge and skill, A need for training, Computer experience, Internet access, Preparedness, and Network constraints. Although the majority of people with low income also use digital technology, access is unstable and unsustainable (Gonzales, Calarco & Lynch, 2020)

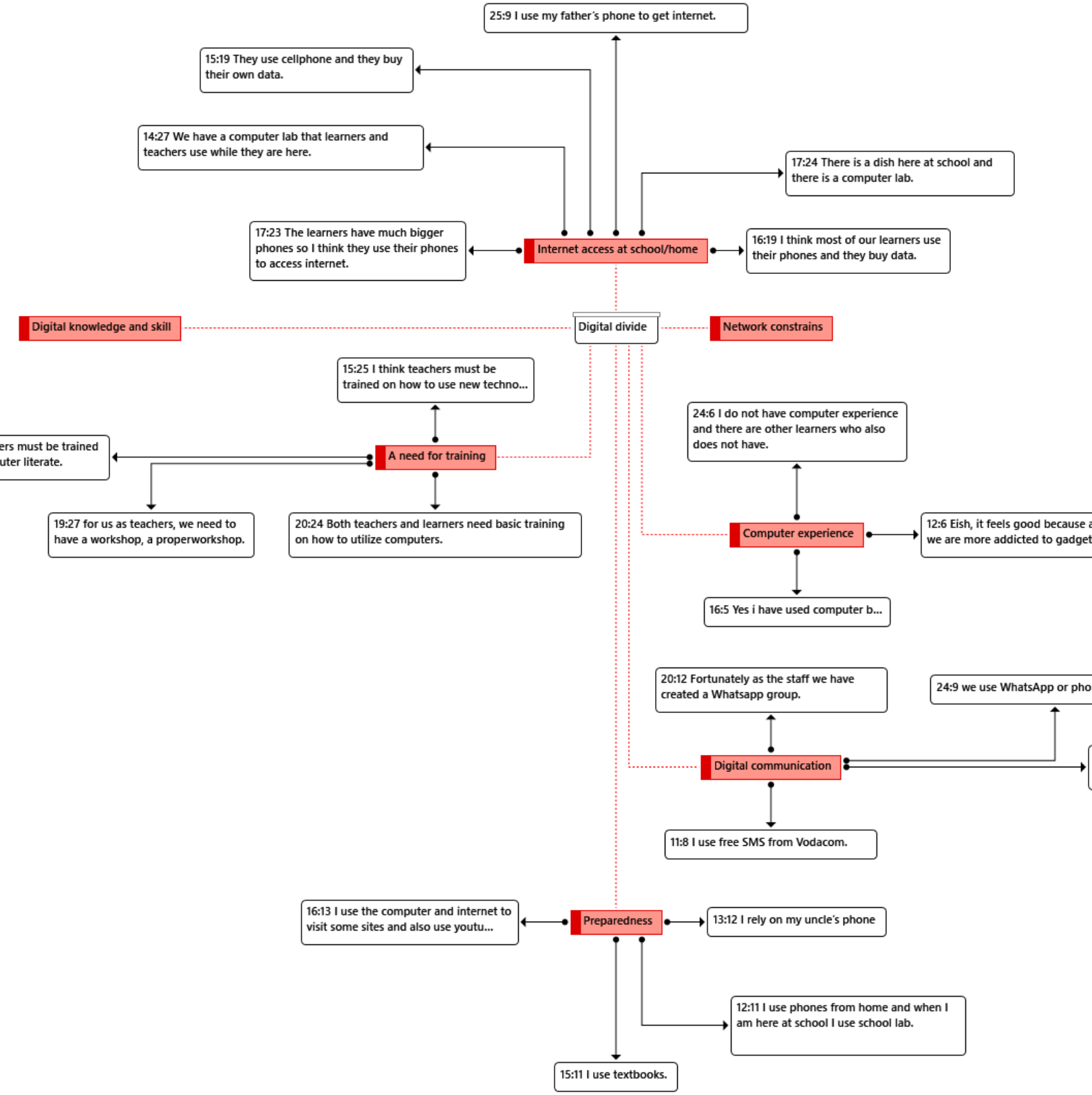

Figure 4.8: Network diagram: Digital divide

The figure above summarises the codes driven from the theme Digital divide. In addition to the summary, the theme and sub-themes also shared related participants' quotations.

The findings of this research revealed that even though some people have access to the internet from home or school, internet access is seen as a challenge that could prevent the implementation of e-learning technology in rural areas. For those who have internet access, the need for training is also another serious factor, as some people have less digital knowledge and some people do not have computer experience at all. Even though some people do have computer experience, there is evidence that network constraints in some areas will be a big challenge. There is also evidence that the implementation of e-learning technology could help teachers and learners to prepare academically.

4.3 EDUCATIONAL STRATEGY

This section outlines emergent points concerning educational strategy. These points are important in educational strategy and include:

- Delivery method
- Policies and laws
- Productivity applications
- Usage patterns

Teaching is a complicated exercise that requires an interweaving of using different specialized skills and knowledge and this is essential for real time online learning to take place (Koehler, Mishra & Kereluik, 2014).

Figure 4.12 at the end of the section summaries this theme.

4.3.1 DELIVERY METHOD

The way in which lessons are delivered to learners, plays an important part in the ability of learners to be able to understand, either online delivery or face-to-face delivery. The delivery method can affect the pass rate.

Participants were asked to comment on how they would like or expect lessons to be delivered during real-time online learning. One learner commented: “I think they should just record maybe a 30-minutes lesson and send it to learners, and we watch it and ask questions, because if the teachers go live there might be interactions. Sometime being live can help, but when the teacher recorded it, you can be listening to it any time you like, but when the teacher is live, it only appears once” [L1CA]. Another learner [L2CA] feels that the teachers will have to facilitate and create chats groups that will help learners to have discussions together with the teachers. Furthermore, a third learner commented: “If it is done live, learners might feel free to participate” [L3CA].

However, one teacher [T1CA] believes that any delivery method can be learned: “That would depend on people, I mean you can always learn new things and technologies if you are willing to. So in terms of delivery method, teachers can learn how to deliver online and teach learner[s]”. Interestingly, the second teacher [T2CA] feels that it would be simple to learn how to deliver online. However, T3CA believes that it would depend on people: “I mean, you can always learn new things and technologies if you are willing to. So in terms of delivery method, teachers can learn how to deliver online and teach learners” [T3CA].

On the other hand, a teacher from Case B commented: “Well, in terms of the delivery method I think there is a need for proper research on what online delivery method works best” [T1CB]. Interestingly, the second teacher for Case B believes that they can learn to deliver online as teachers and learners can also adapt: “We have learned how to deliver as teachers, so we can still learn online delivery methods” [T2CB]. Furthermore, Case B principal believes that the best way to deliver will be when the teacher does it live [P1CB]. As for Case B learners, two of them commented: “I do not know any method or how to deliver online” [L1CB, L2CB]. However, Case B's third learner [L3CB] belies that when the teacher delivers live there will be interaction.

The above comments are justified by results from the paper-based questionnaires as can be seen in Figure 4.9. Most participants from both Case A and Case B specified that lesson delivery through e-learning technology would be simple and easy.

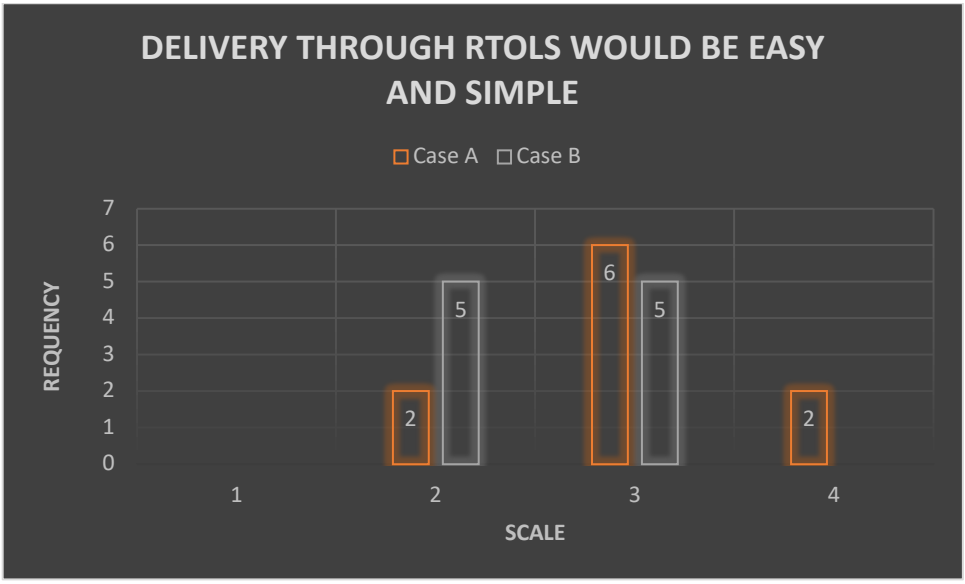

Figure 4.9 : Delivery methord through RTOLs

The graph above illustrates the responses from the learners regarding the statement: Delivery through RTOLs would be easy and simple. The majority of learners for both Case A and Case B indicated that it would be easy and simple for lessons to be delivered online. Most learners rated it as a 4 on the scale of 1 to 4, few rated it as a 3 and none rated it as a 2 and 1, where 1 represents strongly disagree and 4 represents strongly agree. This question can be found in Questionnaire A, question 10 (Q10) in Appendix F.

4.3.2 POLICIES AND LAWS

Policies and laws help to govern the ways in which organisations operate. Whether it is a corporate or an educational institution, there is a need for policies to be put into place to guide and enforce learners and staff to abide by policies. Academic staff was asked to comment on the policies and laws that they think should be implemented, and Case A principal stated: “There must be policies that assist in how the system should be used” [P1CA]. Furthermore, all teachers [T1CA, T2CA, T3CA, T1CB, T2CB, and T3CB] believe that there must be programs to govern the usage of devices, laws, and regulations. The principal for Case B further remarked: “There must be some regulations, there must be some sort of restrictions on which site they can visit and which they cannot” [P1CB].

The above comments are defendable by results from the paper-based questionnaires as seen in Figure 4.10. The majority of participants from both Case A and Case B indicated that there is a need for policies and laws to be implemented.

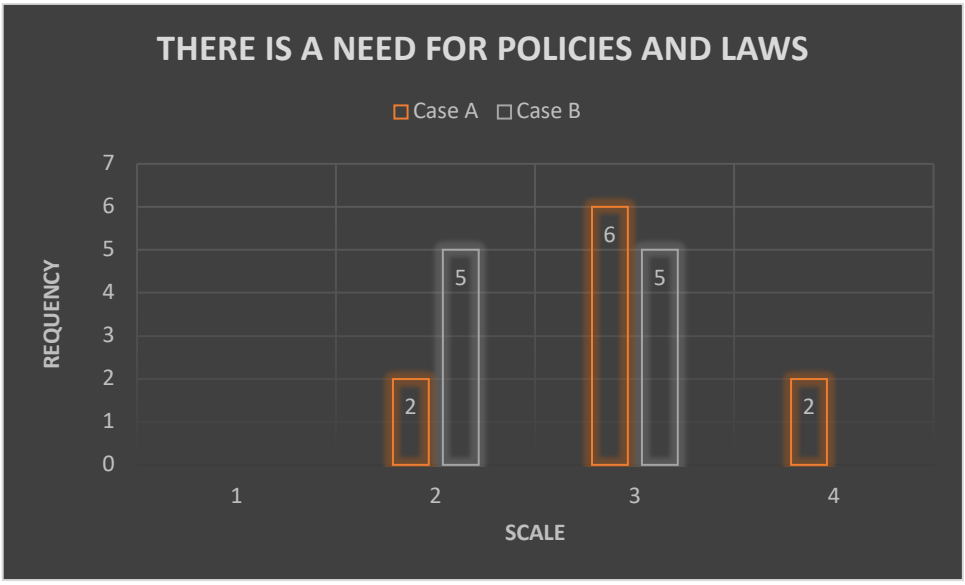

Figure 4.10: Need for policies and laws

The graph above illustrates the responses from the learners regarding the statement: There is a need for policies and laws to be implemented to govern learning through e-learning technology. The majority of learners for both Case A and Case B indicated that there is a need for policies and laws to be implemented to govern learning through RTOLs. All learners rated it as a 4 on the scales of 1 to 4, where 1 represents strongly disagree and 4 represents strongly agree. This question can be found in Questionnaire A, question 11 (Q11) in Appendix F.

4.3.3 PRODUCTIVITY APPLICATIONS

The usage of productivity applications increases chances for both teachers and learners to learn new ways of teaching and learning. This also help teachers and learners to enhance their digital knowledge and skills. Teachers pointed out the digital productivity applications that they could use, or that they are currently using for teaching and learning.

The first teacher from Case A said: “I always use PowerPoint presentations for my lessons in class and it helps us to navigate” [T1CA]. Furthermore, two other teachers [T2CA, T2CA] from Case A also indicated that they also use PowerPoint and video clips. The same applies to teachers in Case B. They indicated that they also use links: “There was this link that shows ‘play here’ and it gives you examples that learners can relate and it was fascinating” [T1CB, T2CB]. Furthermore, the third teacher said: “Mostly to connect to a projector when conducting my classes” [T3CB].

The above comments are justified by results from the paper-based questionnaires as seen in Figure 4.11. The majority of participants from both Case A and Case B specified that they would be comfortable with teachers using some productivity applications.

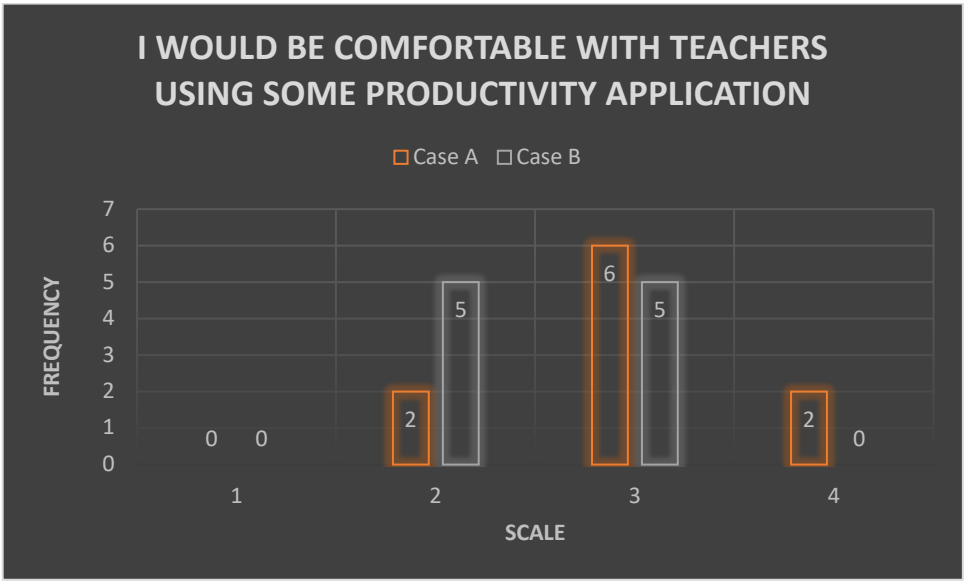

Figure 4.11: I would be comfortable with teachers using some productivity application

The graph above illustrates the responses from the learners regarding the statement: I would be comfortable with teachers using some productivity application. The majority of learners for both Case A and Case B indicated that they would be comfortable. Most learners rated it as 4 on the scale of 1 to 4, few rated it as a 3 and 2 and none rated it as a 1, where 1 represents strongly disagree and 4 represents strongly agree. This question can be found in Questionnaire A, question 12 (Q12) in Appendix F.

4.3.4 USAGE PATTERNS

Participants point out their ability to use computers for educational purposes and the first learner from Case A said: “Yes, yes I have used it before for educational purposes” [L1CA]. A second learner from the same case also indicated that she has used a computer before by simply saying, “Yes” [L2CA]. However, in the same case, one learner voiced that she has not used computers that much: “Ah, not so much” [L3CA].

A teacher [T2CA] from Case A indicated that the majority of them always use computers for educational purposes when they present their lessons. Also T3CA said:

> *I remember weeks back I have downloaded some slides to use on the projector in class.*

However T3CB indicated that he had never used computers for educational purposes. One principal [P1CA] indicated that he has used a computer for educational purposes, Of the teachers ± 60% use a computer, but only ± 4% of the learners use it, because most of them come from very disadvantaged areas and they only provide for Grade 12 learners.

On the other hand, learners from Case B indicated that they have never used computers: “No, I have never used a computer in my life, but some of our teachers use it” [L1CB]. Furthermore, L2CB added: “We do not have a computer here at school and I also do not have a personal computer”, and L3CB simply said, “No”.

When commenting, some Case B teachers indicated that they have used computers and they still use computers for educational purposes. The first teacher [T1CB] said he uses a computer almost every day. Additionally, the second teacher remarked: **“**Yes, I use a computer for educational purposes” [T2CB]. However, the third teacher indicated the shortage of computers and a lack of skills: “Eish, unfortunately, we do not have enough computers and even our learners and some teachers are computer illiterate”**.** In addition to this, the principal for Case B observed: “Yes, some of them, but some cannot use computers, including me, I struggle with computers” [P1CB].

4.3.5 EDUCATIONAL STRATEGY: CONCRETISATION

Figure 4.2 below summarises a network diagram reflecting the theme Educational strategy and its emergent sub-themes. The sub-themes are Productivity applications, Polices/Laws, Delivery method, and Usage patterns.

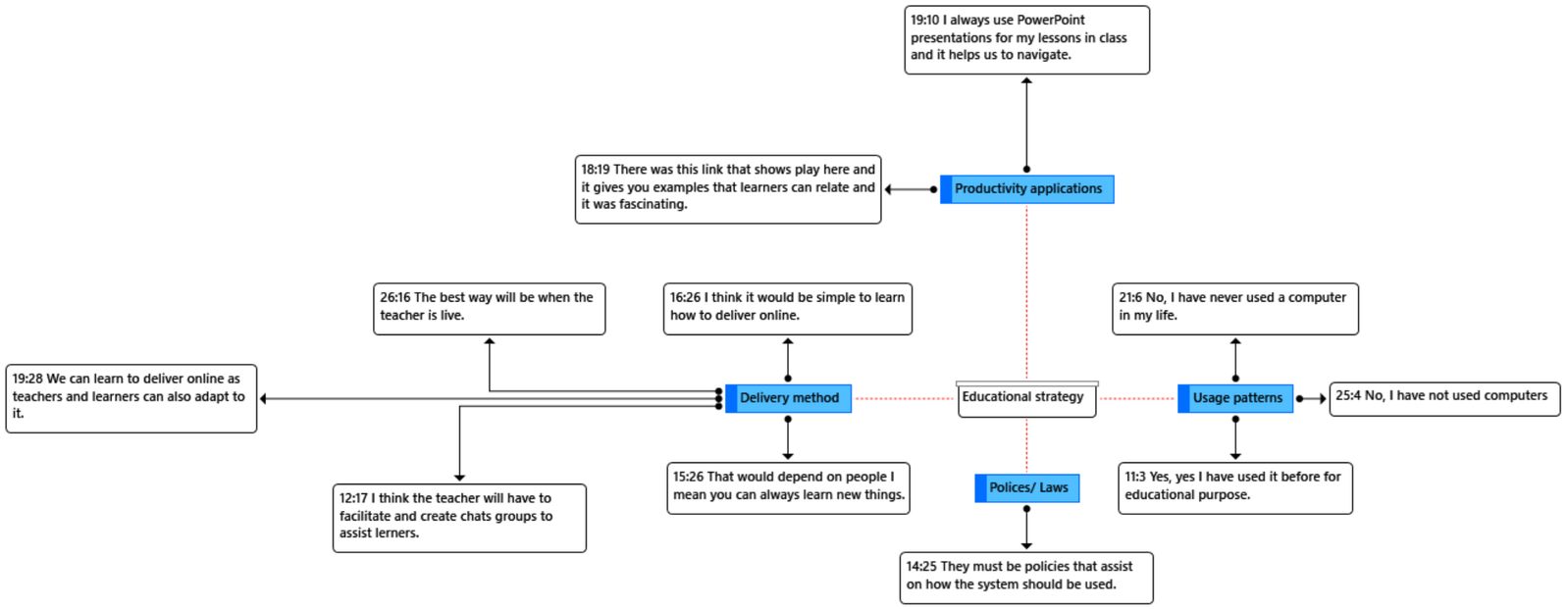

Figure 4.12: Network diagram: Educational strategy

The figure above summarises the codes derived from the theme Educational strategy. In addition to the summary, the theme and sub-themes also shared related participants' quotations.

The findings of this research revealed that most of the teachers can use digital devices for teaching and learning. This includes using PowerPoint presentations and PDF documents. However, for a system like real-time online learning system to function successfully, there must be law and policies implemented to guide both learners and teachers. Learners feel that how lessons should be delivered online is also important, and some learners even feel that teachers should create online chats groups that will support them when teachers are offline. However, some learners feel like it would be best for teachers to always be online. Some teachers believe that online delivery methods can be learned by teachers and learners and thus they can adapt to it. Furthermore, the implementation of e-learning technology could simplify teaching and learning in Limpopo. The participants indicated that RTOLs would simplify educational challenges that affect teaching and learning in general during the floods and protests. Many of the participants walk a long distance to school and as a result they sometimes miss lessons.

4.4 HUMAN FACTOR

This section outlines developing opinions regarding how humans can respond to real-time online learning. The human factor could be important on how people view e-learning technology, information from the literature indicates that when it comes to the advent of any new technology, perception, attitude and intention to adopt are relatively low (Van Dijk, 2017). There are some motivational factors in the adoption of new technology, and most of them are social or cultural with a mental or psychological nature. These opinions include:

- Adoption
- Attitude
- Reaction
- Simplification
- Perception
- Time-related working experience

Figure 4.17 at the end of the section summarises this theme.

4.4.1 ADOPTION

In this section, participants were questioned about their view on the adoption of real-time online learning.

The first learner for Case A stated: “Yes, it will be simple. As learners, we are always excited to learn using gadgets” [L1CA]. Furthermore, the second learner [L2CA] said she thinks that it will be very simple to adapt and it would be very helpful. Moreover, the third learner for Case A responded: “It would be easy to adapt” [L3CA].

Learners’ comments were also supported by those of the teachers: “I think both majorities of teachers and learners will be able to adapt” [T1CA]. However, T1CA believes that due to his age, he cannot adapt. Likewise, the second teacher [T2CA] indicated that there are two groups of teachers – for some, it will be simple, but for some it will be difficult. Furthermore T3CA believes that learners will adapt very quickly.

Correspondingly, the principal for Case A also said: “It will be very simple to adapt” [P1CA].

Learners from Case B seem to have a different view. Some believe that with the lack of digital knowledge there will be some challenges and others feels that it would be extremely simple. The first learner commented: “It will be very simple, we will be able to adapt” [L1CB]. However, the second learner commented: “I don’t think it will be simple, because I do not know the usage of gadgets. I think it will take some time” [L2CB]. The third learner [L3CB] also believes that although it will be difficult for them to adapt … but give the time and they would.

The first teacher from Case B believes that there will be different categories: “I mean you would have categories in terms of population of teachers – you will have those who are about to exit the system, those who are in the middle and those who have just arrived” [T1CB]. The second teacher [T2CB] feels that it can simplify many issues and it would be simple to adapt. Furthermore, the third teacher also sees the possibilities “Yes, it will be simple to adapt to” [T3CB]. However, Case B principal believes that there is a need for training for them to be able to adapt. This is supported by his comment: “Maybe if you train me first, if you teach me how to use a computer, I might be able to use it” [P1CB].

The above comments are justified by results from the paper-based questionnaires as seen in Figure 4.13. The majority of participants from both Case A and Case B specified that it would be simple to adapt to RTOLs.

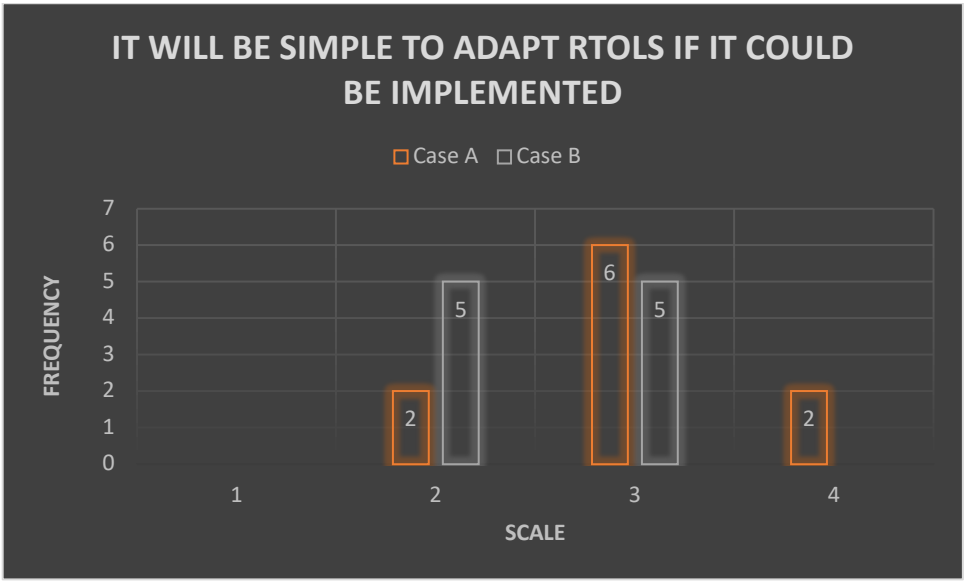

Figure 4.13: Adapting RTOLs

The graph above illustrates the responses from the learners regarding the statement: It will be simple to adapt RTOLs if it could be implemented. The majority of learners for both Case A and Case B indicated that they would be comfortable. Most learners rated it as a 4 on the scale of 1 to 4, few rated it as a 3, none rated it as a 2 and 1, where 1 represents strongly disagree and 4 represents strongly agree. This question can be found in Questionnaire A, question 13 (Q13) in Appendix F.

4.4.2 ATTITUDE

How people perceive something is very important. When participants were questioned about how they feel about the possibilities of RTOLs, they gave their opinions. Two learners from Case A said that they would be excited to know that they would be able to have contact and interact with teachers [L1CA, L2CA]. However, one learner believes that other learners would use it for personal purposes [L3CA].

A Case A teacher [T1CA] indicated that it can only work for others, but not for him. However, the second teacher [T2CA] believes that if the attitude is good, then the pass rate will increase. The third teacher believes that it will be so interesting [T3CA], and he added: “Even now you could see and feel that everyone is excited” [T3CA]. The same view is shared by the principal: “I think it would be very exciting for teachers. As for learners, they will be happy because they like gadgets, they like exploring” [P1CA].

4.4.3 REACTION

How people react to change or the implementation of e-learning technology could also play an important role. Participants commented on how they think the reaction would be. The first learner from Case A said: “By my thoughts, they will be happy and I will also be happy because it will be a huge relief, because it will even save us from carrying a lot bundle of books” [L1CA]. The second learner [L2CA] also feels that they will be more excited about such a system and they would adapt to it very easily**.** Similarly, the third learner [L3CA] thinks they would be very happy.

Teachers from Case A also commented positively. This is supported by the first teacher’s comment saying: “I would encourage everybody to accept” [T1CA]. Furthermore, the second teacher [T2CA] indicated that he would be very happy. Last teacher of Case A’s feeling is mutual as he revealed: ”You see I would love it very much. I'm there already – obviously I will be more excited” [T3CA]. The positive reactions in Case A indicated by the principal’s comment: ”Their reaction would be very good, they will react very positively” [P1CA].

Case B’s reaction also seems positive [L1CB]: “I will be excited, I will be very happy. Similarly L2CB and L3CB both indicated that they will be happy. Case B teachers also feel that the reaction will be good. This is supported by the first teacher who commented: “From my point of view, I would be happy” [T1CB]. Furthermore, the second teacher said: “Learners will react positively, because if you can check kids nowadays are addicted to gadgets”. These claims are also supported by the third teacher: “Learners will be happy because they are also always on social networks like Facebook and WhatsApp, and that will make it too simple for them to react positively to such a system” [T2CB]. Finally, the third teacher and principal from Case B also feels that they will react positively as they both said: “Their reaction will be positive” [T2CB, P1CB].

The above comments are justified by results from the paper-based questionnaires as seen in Figure 4.14. Several participants from both Case A and Case B specified that other learners would react positively towards RTOLs.

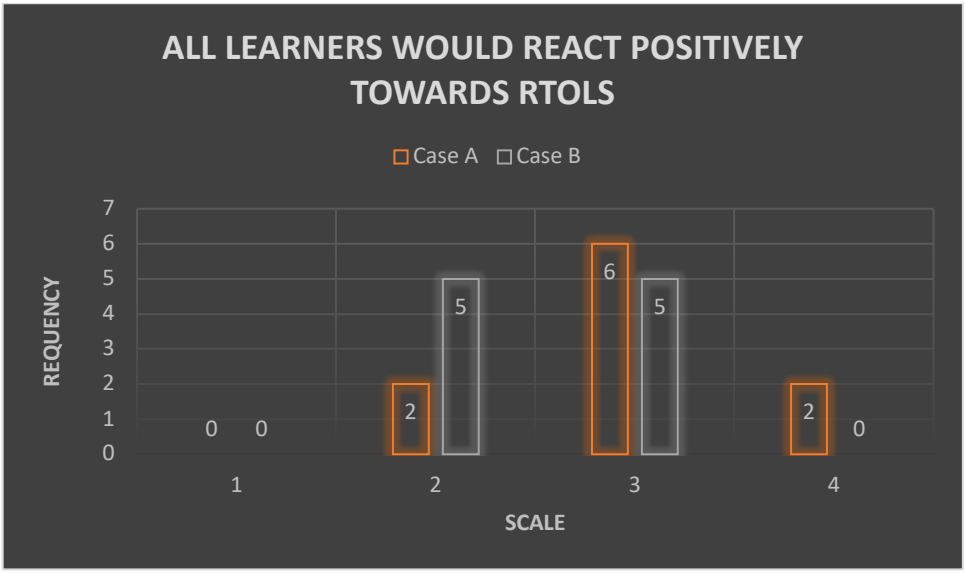

Figure 4.14: Reaction towards RTOLs

The graph above illustrates the responses from the learners regarding the statement: All learners would react positively towards RTOLs. The majority of learners for both Case A and Case B indicated that they think other learners would react positively. All learners rated it as a 4 and 3 on the scales of 1 to 4, where 1 represents strongly disagree and 4 represents strongly agree. This question can be found in Questionnaire A, question 14 (Q14) in Appendix F.

4.4.4 SIMPLIFICATION

The implementation of e-learning technology is supposed to simplify the education system in the rural areas of Limpopo, particularly Vuwani and Lukalo. When they were asked how they think RTOLs will simplify teaching and learning, participants shared their views. The first learner commented: “It will even be time-saving. It will even save us from coming to school for extra lessons like on Saturday and Sundays (Weekend classes), because we can just do it from home” [L1CA]. Additionally, the second learner said: “You see here in rural areas there is a time whereby it is very rainy and we as learners we are unable to come to school, so this system would be a solution, because we can also be able to learn from home” [L2CA]. Correspondingly, L3CA feels that this will assist, because some learners are visual learners.

The feeling is mutual for Case A teachers, as the first teacher commented: “That would simplify teaching and learning. I think it will simplify in the following way: learners who are not able to come to school will be able to have access to information, and I think learners will also be able to communicate with other learners and teachers and would be able to compare themselves with other provinces if connected” [T1CA]. Moreover, the second teacher [T2CA] added that it will simplify teaching – all lessons could be recorded for backup and learners would be able to watch them later for better understanding.

Furthermore, T3CA feels that It will be very simple, because as a teacher he can just connect and show learners anytime, anywhere, whenever they have some issues. That will help, because teaching and learning will always take place, and as a result, RTOLs would solve educational challenges in this rural area. He added: “Number one, it makes life easy. Number two, wherever you are you can still relate information – it keeps you in constant contact. Like for example, today it’s Friday. Whenever you come back Monday, if you don't have Saturday classes, it means that you will go for two days (48 hours) with no interaction that brings learners closer. Remember it's not about actually teaching that makes one wise but how you relate” [T3CA].

The principal [P1CA] also believes that it could improve learning and teaching, since there would always be interaction between learners and teachers.

Case B participants also feel that this system would simplify learning and teaching. These claims are supported by the first learner’s comment: “It will simplify, as we could have constant contact with teachers and be able to research online” [L1CB]. Furthermore, the second learner also feels the same way as she assumed: “There will always be contact between learners and teachers” [L2CB]. The third learner remarked: “There will always be some form of interaction between us and teachers and among ourselves” [L3CB].

Case B teachers also believe that RTOLs will simplify the process of teaching and learning as the first teacher stated: “I can imagine, I am sitting at home, picking up a question, copy it and paste it for learners to do. They start answering, they send feedback, I send feedback … ah … I mean what more do you want? I mean, this is

everything that learners need" [T1CB]. Furthermore, T2CB thinks RTOLs will improve marks and performance, because there will always be contact between teachers and other learners.

T3CB indicated that RTOLs might simplify issues of teaching and learning in rural areas. However, P1CB believes that this system will be more helpful during protests: "Even during the protests, weekends, and during the holidays, we can be able to always keep in contact with the learners" [P1CB].

The above compliment results from the paper-based questionnaires as seen in Figure 4.15. The majority of participants from both Case A and Case B specified that RTOLs would simplify teaching and learning in rural areas.

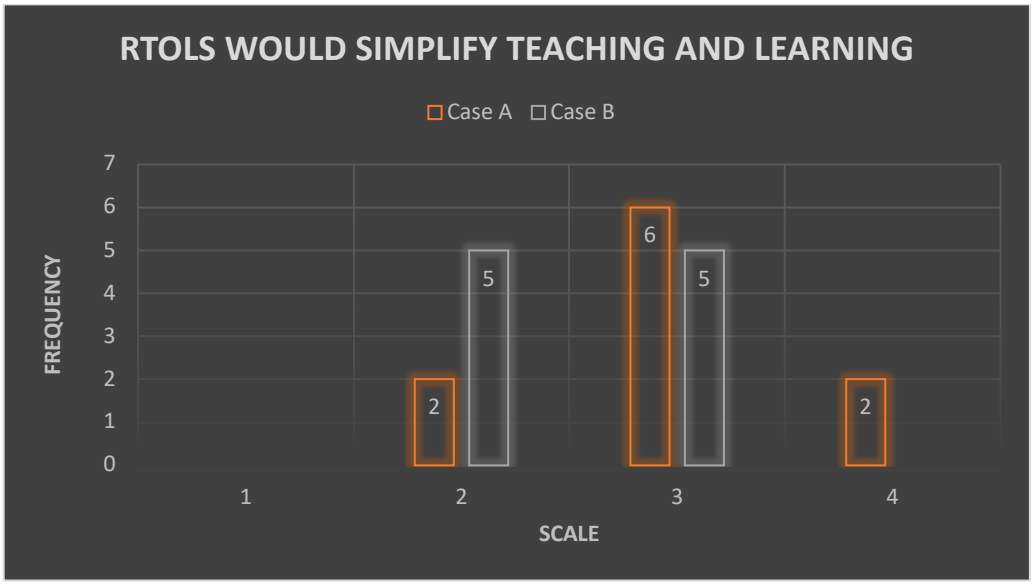

Figure 4.15 : RTOLs would simplify teaching and learning

The graph above illustrates the responses from the learners regarding the statement: RTOLs would simplify teaching and learning. The majority of learners for both Case A and Case B indicated that RTOLs could simplify teaching and learning in rural areas. The majority of learners rated it as a 4 on the scale of 1 to 4, and only a few rated it as a 3 and 2, where 1 represents strongly disagree and 4 represents strongly agree. This question can be found in Questionnaire A, question 15 (Q15) in Appendix F.

4.4.5 PERCEPTION

As perception is the ability to see, hear, or become aware of something through the senses, participants had the following to say about their perception on RTOLs: L1CA feels that these RTOLs might give the option to choose which teacher they need for a specific subject . Additionally, the second learner stated: “I think it would be a solution, because I won't find myself behind anymore and if a lesson is recorded I can even catch up later on after a few days” [L2CA]. The third learner believes that he would always get information, “If a learner is not able to come to schools due to some challenges with such a system, they can be able to learn and get some information from home or wherever they are” [L3CA].

Furthermore, the first teacher viewed his perception as he remarked: “Yes, when a learner is not able to come to school they can connect and also the availability of study material” [T1CA]. Likewise T2CA believes that this could be a solution: “You see from what I have seen we sometimes have a situation where our learners are out of schools for about three months or so and that is quite a long time. So if we had RTOLs available, teaching and learning could continue during those challenging times” [T2CA]. However, the third teacher had a different perception: “Yes, but only if those problems are addressed, if the internet speed can be increased and we use 4G or 5G and there can be sustainability, then RTOLs can be a solution” [T3CA]. Teachers' perception is supported by that of Case A principal who assumed: “RTOLs would be very beneficial and a solution to issues faced with teaching and learning in our area**.** It can simplify teaching and learning because there will always be learning (24 hours, 7days a week)” [P1CA].

The same perception is also shared by participants in Case B, as the first learner commented: “Yes, I think it could be a solution, but I think some people will start abusing it. They won't come to school, knowing that they can still learn from home” [L1CB]. Furthermore, L2CB said in terms of interactions, it could be a solution, because if there are protests they can just stay at home and learn via the internet and through online teacher contact. Correspondingly, L3CB said: “It can assist because teachers can keep contact with learners even during the weekends or when there are some protests”.

The perception of Case B's first teacher seems to be very positive as he commented: “No doubt about that, because you will remember one thing, education today is far different from education yesterday. Parents need to be 100% involved if there is RTOLs. They will have interaction contact with the educators whenever they feel like it and [it] will increase the level of interest in terms of education” [T1CB].

Furthermore, T2CB added: “This will bring a solution because even during protest, teaching and learning would continue, since there won’t be any need for physical contact, which means there will be continuous interaction between learners and teachers” [T2CB]. T3CB believes that learners would be able to learn even when they are at home: “Learners would be able to ask teachers to help them during protests and when any other issues are preventing them from coming to school. The principal also gave his perception: “Yes, especially in our areas where we have those kinds of disturbances, I think we will be able to improve our marks and performance” [P1CB].

The above comments are justified by results from the paper-based questionnaires as seen in Figure 4.16. The majority of participants from both Case A and Case B feel good about RTOLs.

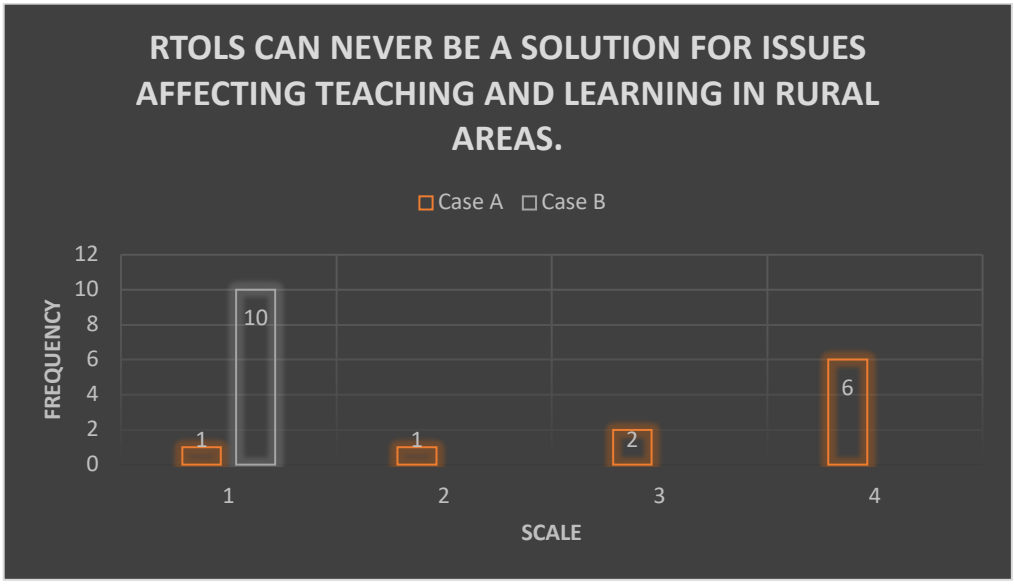

Figure 4.16: RTOLs solution for teaching and learning

The graph above illustrates the responses from the learners regarding the statement: RTOLs can never be a solution for issues affecting teaching and learning in rural areas. The majority of learners for both Case A and Case B indicated that RTOLs could work

and simplify teaching and learning in rural areas. The majority of learners from Case A rated it as a 4 on the scale of 1 to 4, where 1 represents strongly agree and 4 represents strongly disagree. However, the majority of learners from Case B rated it as a 1. This question can be found in Questionnaire A, question 16 (Q16) in Appendix F.

4.4.6 TIME-RELATED WORKING EXPERIENCE

Different age groups for teachers could affect how they see things and influence their readiness to accept change and their attitude towards new things. Old teachers usually feel that there is no need for them to learn new things. This evidence is supported by a teacher who commented: “I have plus or minus 36 years of experience. I will be retiring next year. I am only left with one year; I think for other teachers they can learn not me” [T1CA]. However, younger teachers feel that they could be able to adapt and accept new changes. T2CA indicated: “I have been a teacher for five years now and I am always willing to learn new things”. T3CA also said that he has been a teacher for about 10 years now and he is ready to learn new technology. Furthermore, a principal [P1CA] added that he has been a teacher for about 19 years – six of which was as a principal – and he is still willing to learn.

On the other hand, a teacher [T1CB] from Case B seems to be having moderate experience as he explained that he has been a teacher for ± 9 years. Furthermore, two other teachers both commented: “About 5 years of experience” [T2CB, T3CB]. However, the principal commented by saying: “I have been a principal since 2006, which is now 13 years, and many more years as a teacher” [P1CB].

4.4.7 HUMAN FACTOR: CONCRETISATION

Figure 4.17 below summarises a network diagram of the theme Human factors and its emergent sub-themes. The sub-themes are Adaption, Attitude, Simplification, Perception, and Time-related working experience.

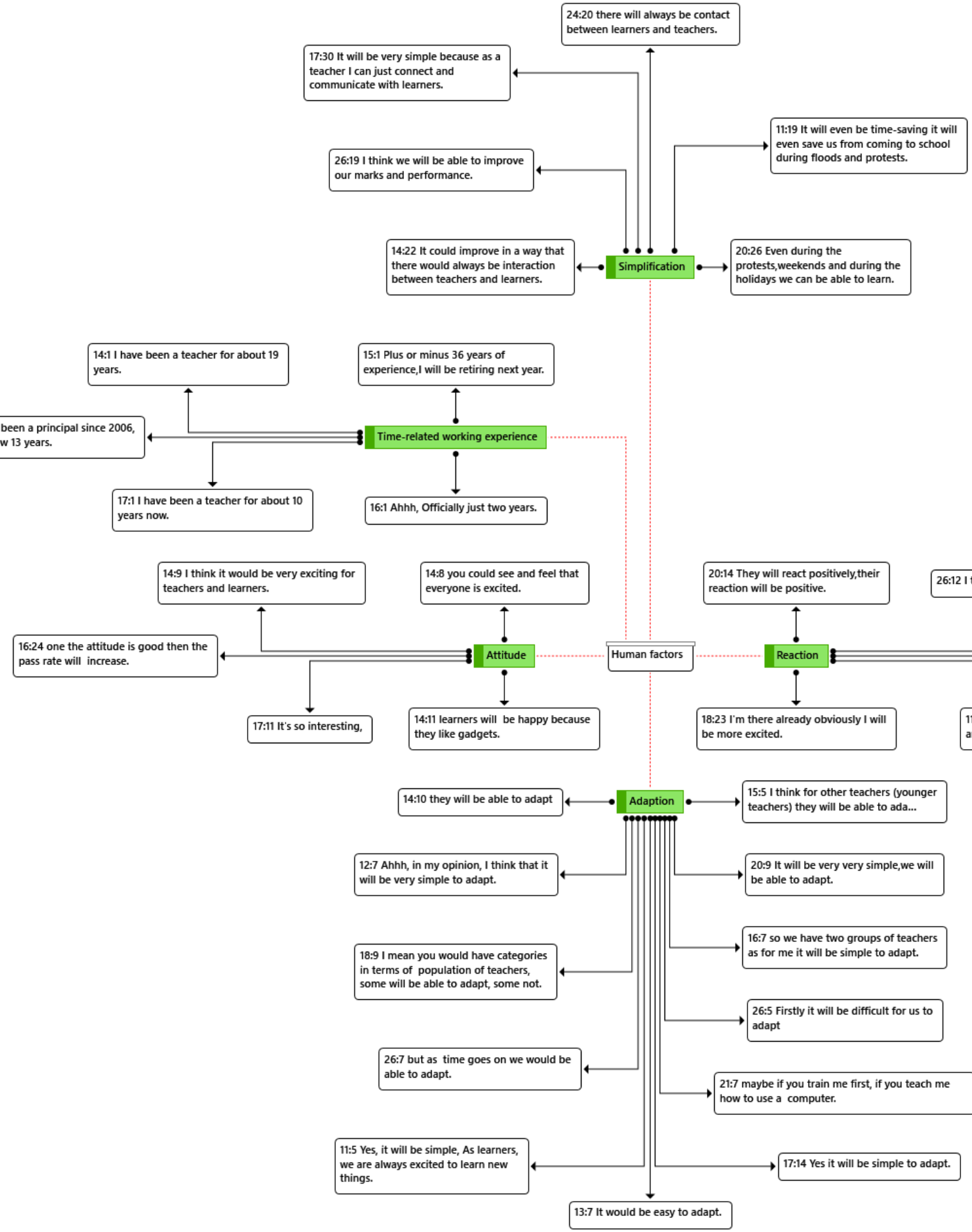

Figure 4.17: Network diagram: Human factor

The figure above summarises the theme Human factor and its five codes.

In addition to the summary, the theme and sub-themes also shared related participants' quotations. Findings revealed the positive reaction towards the implementation of a real-time online learning system and the majority indicated that they will be happy to see such a system implemented. This simply indicates that their attitude towards e-learning technology is positive. In terms of adaption, teachers and learners seem to be positive as they indicated that it should be simple to adapt. Participants have indicated that learners are always ready to learn new things and it would be simple to adapt. In terms of time-related working experience, there is enough evidence that there are mixed groups – some teachers have less teaching experience than others. Teachers with more experience (old teachers) feel that it would be difficult for them to learn new technology, and those with less learning experience (younger teachers), feel that it would be easy. In terms of simplification, learners and teachers feel that this will simplify teaching and learning during protests and rainy days, as they would always be able to interact.

4.5 SUPPORT

This section outlines emergent issues requiring support. Support should be provided in various ways to resolve issues which include:

- Days missed
- Distance and time
- Lack of government involvement
- Transportation

Figure 4.21 at the end of the section summaries this theme.

4.5.1 DAYS MISSED

Learners are disadvantaged in different ways. Although not all students are absent, absent learners suffer when they miss days at school. One student [L1CA] indicted that he never misses school, but he does arrive late and therefore loses some information during morning classes. Another student [L2CA] commented: "Since I

come from a place with a gravel road and which is not too good, sometimes during rainy days the mini-bridge collapse and we end up not having access to schools, and as a result, we fall behind in terms of schoolwork for about maybe two or three days".

However, the third Case A learner indicated that he does not stay far away from school: "I am always on time as I stay closer" [L3CA].

Teachers also supported the statements made by learners as T1CA commented: "Learners experience challenges particularly when there are protests and during rainy days, when it is raining very heavily, because some learners come from far where roads are slippery during rainy days and they end up missing classes".

The second teacher from Case A feels that learners certainly try to do their best: "Well, learners try to always come despite all those challenges, and I think it is because they see that there is a lot to benefit from this school" [T2CA]. However, the third teacher remarked: "It differs with times – sometimes we deal with cases where learners are missing classes because they are not waking up on time, because of tiredness from long-distance travelling" [T3CA].

The principal indicated: "They are affected during protests and during floods, because we have learners who come from as far as Mubvumoni and even during the exam times they are affected. So they sometimes miss a lot of classes" [P1CA].

On the other hand, two learners [L1CB, L2CB] from Case B indicated that they only miss classes during a light protest. Additionally, L3CB added that since they join this particular school there have been only light protests, unlike the previous years. However, teachers shared a different view as T1CB commented: "A lot of days, if you look into the nature of South Africa, today in every village there is a cry. They have got something that they need for government to do. Sometimes you find there is an unnecessary blockage". Furthermore, according to T2CB, protests lasted for about three months, and T3CB indicated that Teachers and Learners have spent almost three months not attending school. Teachers' claims are supported by those of the principal who said, "Last time we spend almost four months without learners attending lessons here" [P1CB].

4.5.2 DISTANCE AND TIME

The distance that learners and teachers have to travel to and from school can contribute to how they perform academically. Participants commented on distance and the amount of time they have to spend daily to and from school.

For some learners, it takes up to 50 minutes to travel to school as they live far. This is supported by a statement from L1CA who claims that it takes him about 45 minutes to get to school. L2CA stated: “It takes me about 50 minutes”. However, L3CA does not spend a lot of time on travel as he said, “Like I said, I do not come from far, I walk for about 20 minutes”.

It seems that distance also affects teachers. This is evident from T1CA who commented: “Plus or minus 23 km, depending on traffic, sometimes about 30 minutes”. However, T2CA said, “Ah … I live very close by. It takes me about 5 minutes”. Though T3CA indicated that for him it is about 13 kilometres and takes ± 15 to 20 minutes. The principal from Case A commented: “I use my transport and I come from far. It is plus or minus 20 kilometres, and so many learners also come from the same area as me and most of them use public and arranged transports” [P1CA].

As for Case B, all three learners [L1CB, L2CB, and L3CB] mentioned that they do not travel long distances to and from school. However, T1CB indicated that he travels 20 minutes, which is about 29 kilometres. T2CB says that he travels for about 10 kilometres, and T3CB said, “I think the average is about 45 minutes for teachers and maybe 20 minutes for learners, because most of them are within a radius of 5 km”. It seems that most of the teachers travel quite a distance. This is also supported by [P1CB] who commented: “It takes me almost 30 minutes to arrive at work, 22 kilometres that would be covered in 20 minutes”.

The above comments are justified by results from the paper-based questionnaires as seen in Figure 4.18. Some of the participants from both Case A indicated that they travel long distances to schools and they get exhausted. However, participants from Case B indicated that they do not travel long distances.

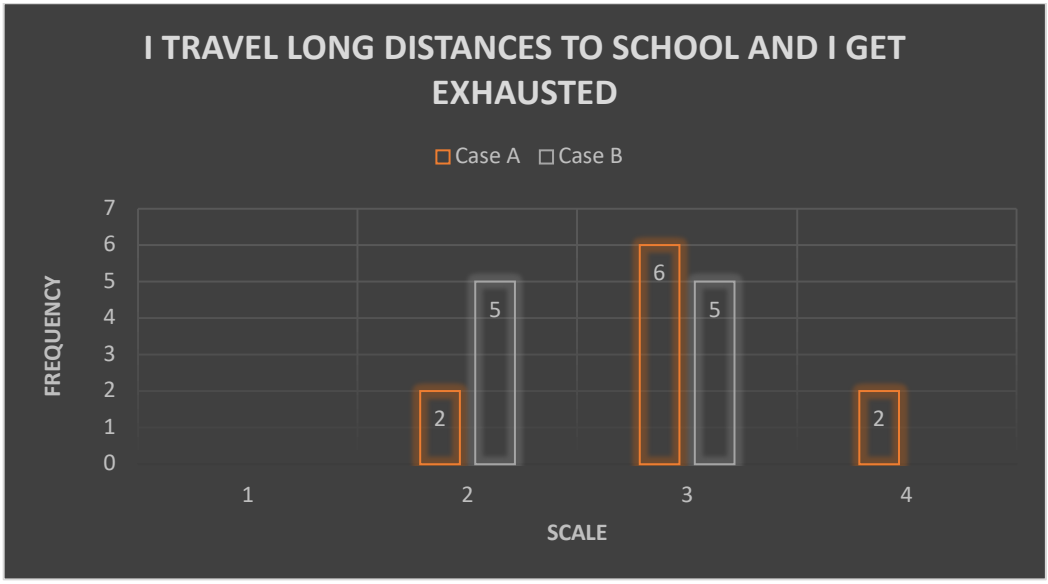

Figure 4.18: Distance traveled to school

The graph above illustrates the responses from the learners regarding the statement: I travel long distances to school, and I get too exhausted. The majority of learners from Case A indicated that they travel long distances, whereas learners from Case B indicated that they don't travel long distance. Some learners rated it as a 4 on the scale of 1 to 4, where 1 represents strongly agree and 4 represents strongly disagree. This question can be found in Questionnaire A, question 19 (Q19) in Appendix F.

4.5.3 LACK OF GOVERNMENT INVOLVEMENT

Government involvement and support plays a key role in a person's life, whether it is socially or academically. When participants were asked about the support that they feel is needed from the government for e-learning technology to be implemented, they gave their views which aligns with the literature that indicated that nowadays computers and digital devices are crucial in the educational environment, therefore, it is very difficult for computer illiterate people to complete their tertiary studies (Herselman, 2018).

A learner feels that the government should fully support these RTOLs, as he said: "We need real support from the government. We need as much support that we can get. It can improve a lot, because you see nowadays many people are addicted to their phones, so it will be simple for them to adapt" [L1CA]. Furthermore, L2CA feels support

from the government is much-needed; teaching and learning would be much simpler, because learners will have access to the internet and they can be able to research their lesson with the teachers. The third Learner from Case A also commented: “We need a lot of support starting from training, network issue, and gadgets” [L3CA].

Teachers also believe that government support is much-needed as one teacher commented: “The government must provide more gadgets and must also provide trainers to train teachers and learners” [T1CA]. However, T2CA feels that the government must give support via better sustained internet connectivity, and also by servicing the equipment and infrastructures. Furthermore, in Case A the third teacher commented: “The government needs to push service providers and make sure that there is a sustainable 5G coverage, because here in the rural areas the internet connection is not so good. The other support from the government will be infrastructures, including the gadgets” [T3CA]. Additionally P1CA feels that the government should provide gadgets and infrastructures and also funding.

Case B learners also gave their views. L1CB said: “Number one we need support such as computers, infrastructures, training, and better network connections”. Moreover, L2CB is of the view that the government should provide good infrastructures and internet connections. Furthermore, L3CB feels that they need all the support that they could get from the government.

Teachers have shared their views and T1CB believes that the first thing should be the supply of gadgets. Furthermore, T2CB commented: “We need gadgets and the training of teachers and learners from the government”. Additionally, T3CB feels that the support they would expect would be for the government to provide them with gadgets and the internet. Also, P1CB believes that there is much support needed like the donation of gadgets.

The above comments are justified by results from the paper-based questionnaires as seen in Figure 4.19. The majority of participants from both Case A and Case B indicated that there must be more government support and involvement for schools in rural areas.

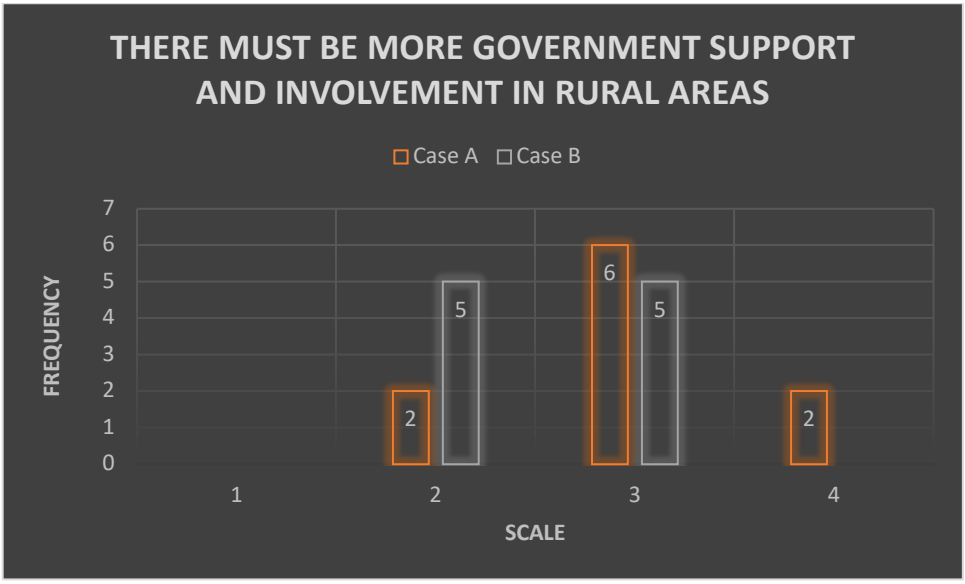

Figure 4.19: Government involvement and support

The graph above illustrates the responses from the learners regarding the statement: There must be more government support and involvement in rural areas. The majority of learners for both Case A and Case B indicated there must be more support and involvement from the government. All learners rated it as 4 on the scale of 1 to 4, where 1 represents strongly agree and 4 represents strongly disagree. This question can be found in Questionnaire A, question 17 (Q17) in Appendix F.

4.5.4 TRANSPORTATION

Participants also shared their experience concerning their mode of transport to school. The first two learners [L1CA, L2CA] indicated that they use transport as they come from far. However, L3CA commented: “I use my legs, almost every day, but I experience a lot of challenges. You see, during rainy days I find it hard to walk through the road, water just come all over the road and you find it hard to walk”.

T1CA said, “I use my car and there are so many learners who come from the same area but they use taxis, others use minibus and others use bikes (organized transport)”. However, T2CA walks to school as he does not stay far and the third teacher said: “I use my private car” [T3CA]. Correspondingly, P1CA said, “I use my transport, a private car. Some learners use buses and some use bakkies”.

All Learners from Case B [L1CB, L2CB, and L3CB] walk to school. However, the majority of teachers [T1CB, T2CB, P1CB] from Case B use their cars. This excludes T3CB who does not have a car and relies on public transport.

The above comments are justified by results from the paper-based questionnaires as seen in Figure 4.20. The majority of the participants from Case A indicated that they travel long distances and transportation is a problem. However, participants from Case B indicated that they do not travel long distances and they do not see transportation as a problem.

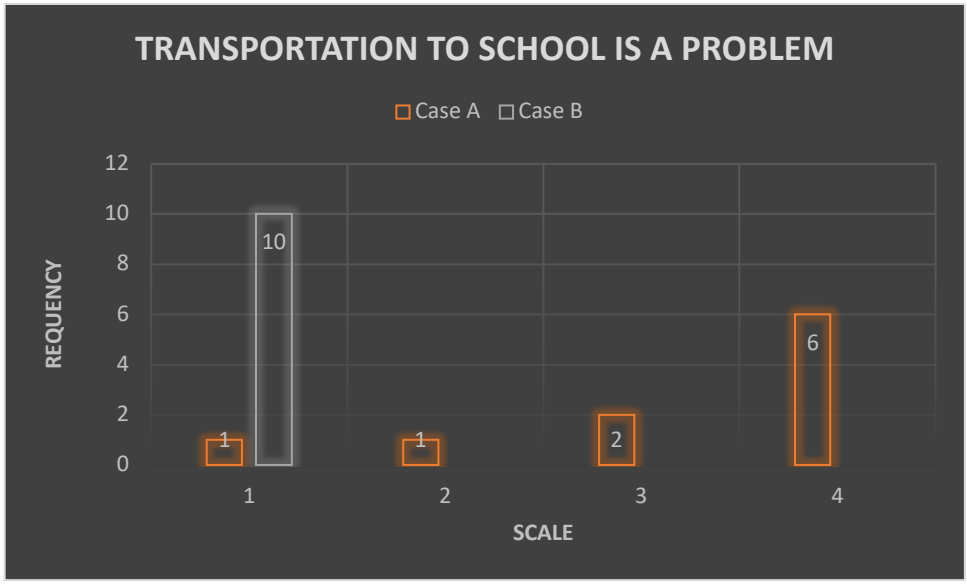

Figure 4.20 : Transportation to school is a problem

The graph above illustrates the responses from the learners regarding the statement: Transportation to school is a problem. The majority of learners from Case A indicated that transportation to school is a problem, whereas participants from Case B indicated that they do not see any problem with transportation. Some Case A learners rated it as a 4 and few rated it as a 2 on the scale of 1 to 4. Case B learners rated it as a 1, where 1 represents strongly disagree and 4 represents strongly agree. This question can be found in Questionnaire A, question 18 (Q18) in Appendix F.

4.5.5 GOVERNMENT SUPPORT: CONCRETISATION

Figure 4.21 below summarises a network diagram of the theme Support and its emergent sub-themes: Days missed, Distance and time, Lack of government involvement, and Transportation.

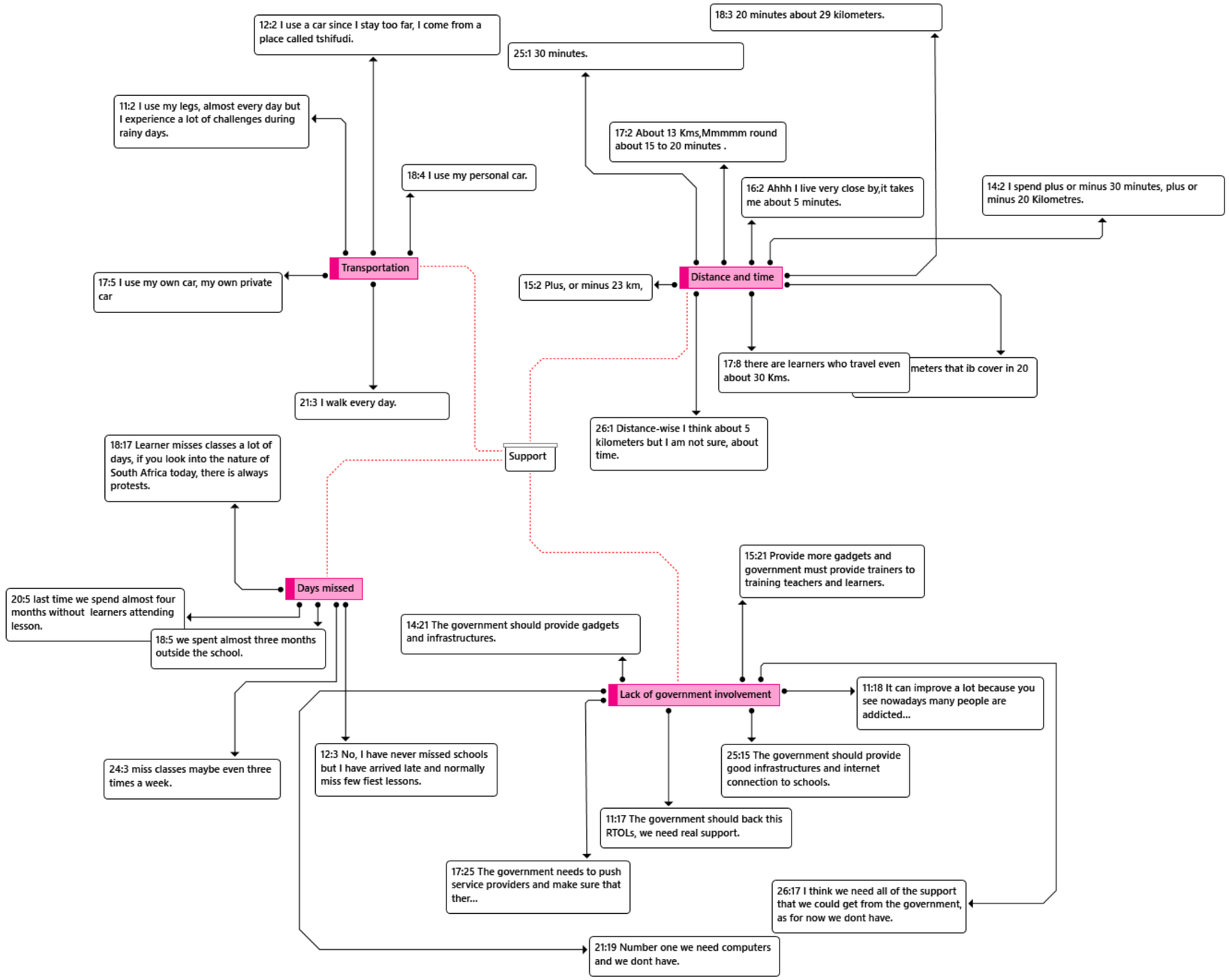

Figure 4.21: Network diagram: Support

The figure above summarises the theme Support and its four codes. In addition to the summary, the theme and sub-themes also shared related participants quotations. Findings reveal: the lack of government support; learners and teachers travel long distances every day to and from school; the distance and time also cause learners to miss classes now and then. Many learners rely on organized transport. There is no involvement from government, or any kind of assistance provided. Therefore, learners who cannot afford to pay for transportation are forced to walk long distances, causing some to miss a few of the first lessons of each day and some miss even up to three days during rainy days. The implementation of e-learning technology will probably solve some of these challenges raised, because teaching and learning will always be possible without the need for any physical classroom.

4.6 AFFORDANCES

This section outlines two important points as follows:

- Catch-up
- Pass rate

Figure 4.23 at the end of the section summarises this theme.

4.6.1 CATCH-UP

There is a need for learners and teachers to catch up on any missed class to give learners a fair chance to cover the whole syllabus. There is a lack of organized catch-up methods for learners to catch up on missed classes.

According to a learner L1CA, when learners are absent, only a few of them follow up the work through friends. It would have been better if there was a system they could use to follow up, even when they are at home. However, L2CA remarked: “I only copy notes from classmates”. Furthermore, L3CA commented:

> *There is no organized ways or method to assist learners when we fall behind. But what we do is to study on our own from home and make sure we are catching up on the work lost. But since as learners we do*

not have that much knowledge, sometimes when you are studying on your own you come across some challenges that need assistance from the teacher.

Two teachers [T1CA, T2CA] from Case A believe that despite all the challenges, learners always try to come to class and copy what they have missed from others. However, the third teacher said: “Things like those don't happen to all learners – so they are only given all the information, all the educational details that they have missed” [T3CA]. However, despite all the evidence from teachers that points out that no extra classes are given, the one principal [P1CA] indicated that they usually encourage educators to conduct some extra classes.

Learners from Case B [L1CB, L2CB, L3CB] all indicated that they do not have any catch-up, since they believe that it is usually arranged for Grade 12 learners. These claims are supported by teachers who indicated that plans are mainly made for Grade 12: “We do what is called a junk program. As educators, we have decided to extend the knock-off school time to try and make up for the lost time, and at some point Grade 12 learners were moved to some place in Tzaneen for about a month” [T1CB]. T2CB said, “Fortunately enough our learners were very positive and they attended all the catch-up lessons”. Furthermore, T3CB explained that for Grade 12 learners the department (LDE) organized a camp. However, according to Case B principal [P1CB] it is very unfortunate that the plans are only made for Grade 12s.

The above comments are verified by results from the paper-based questionnaires as seen in Figure 4.22.

The majority of the participants from both Case A and Case B indicated that they sometimes do miss class and there are no organized catch-up methods.

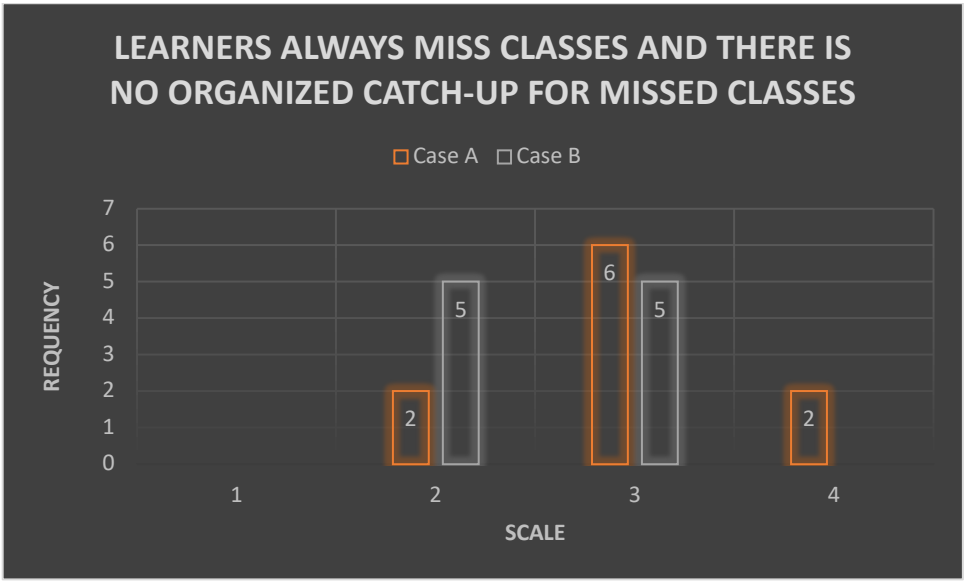

Figure 4.22: Catch-up for missed classes

The graph above illustrates the responses from the learners regarding the statement: Learners always miss classes and there is no organized catch-up for missed classes". The majority of learners for both Case A and Case B indicated that they sometimes miss classes and there are no organized catch-up. The majority of learners rated it as a 3, few rated it as a 2 on the scale of 1 to 4, where 1 represents strongly disagree and 4 represents strongly agree. This question can be found in Questionnaire A, question 20 (Q20) in Appendix F.

4.6.2 PASS RATE

There are so many factors that could affect learners' pass rates. When educators were asked about their thoughts on how RTOLs could improve the pass rate, two teachers [T1CA, T2CA] believe that RTOLs will increase the pass rate. Correspondingly the third teacher elaborated:

> *"Ja … this will improve pass rate, because learners are so lazy to carry textbooks, but having a system that will allow them to access all study materials, will encourage them to always learn and also constant contact will improve pass rate" [T3CA].*

Moreover, P1CA also believes that the pass rate will improve.

Interestingly, Case B's first teacher shared more of his view by saying: "Yes, the pass rate would improve, although this school (JMSC) always produces a 100 % pass rate. I think it will just help to maintain the status and also to improve scores per subject" [T1CB]. Furthermore, the second teacher added: "It would improve a lot. You must have realized that this school is one of those schools that always produces a 100 % pass rate, but the quality is not that good" [T2CB]. Also, T3CA believes that the pass rate will improve, because they would always be able to get information. These claims are supported by comments from P1CB who pointed out that since 2015 they have been getting a 100% pass rate for Grade 12s, and he thinks that maybe it will improve in terms of quality.

4.6.3 AFFORDANCES: CONCRETISATION

Figure 4.23 below summarises a network diagram of the theme Affordances and its emergent sub-themes: Catch-up and Pass rate.

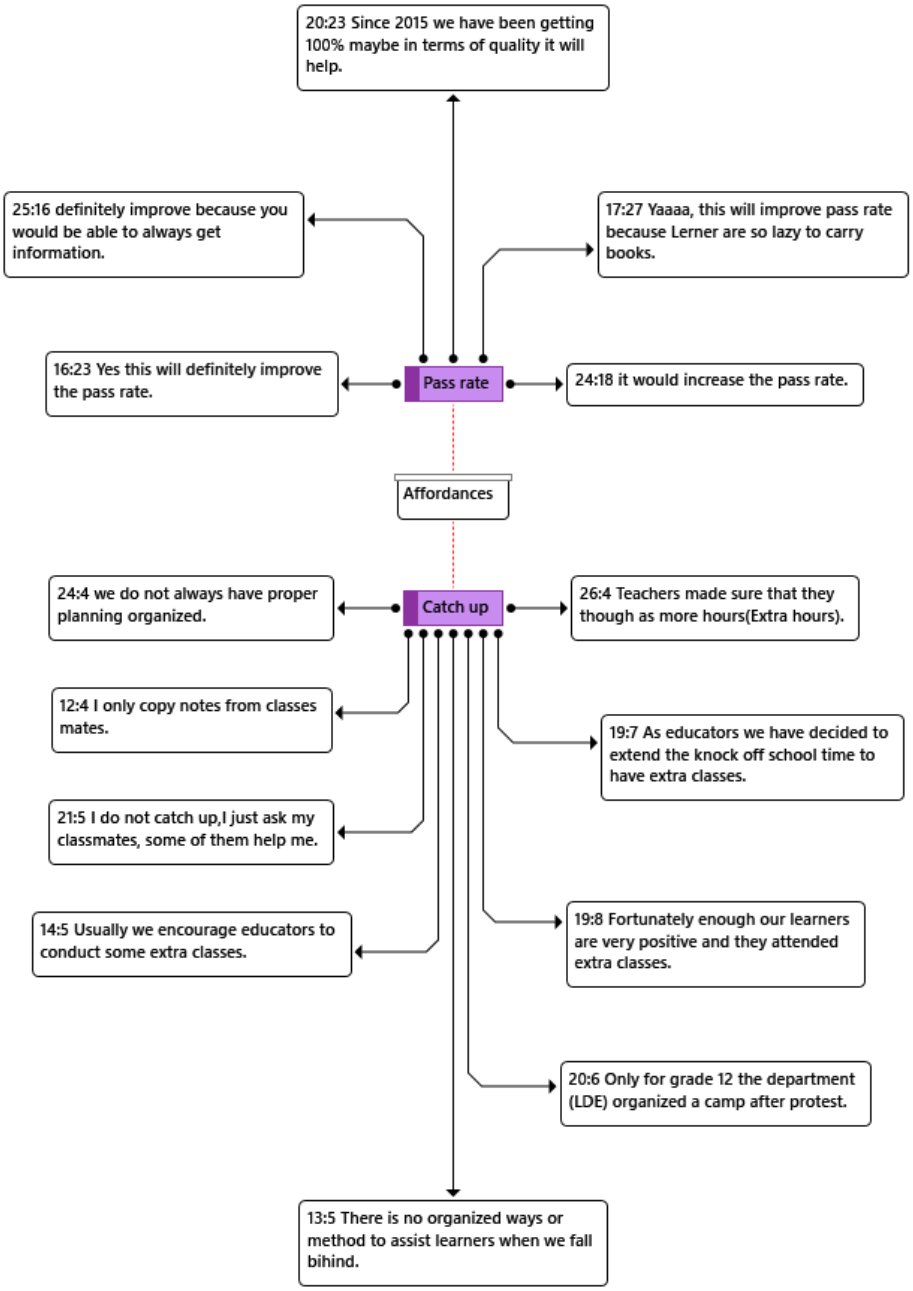

Figure 4.23: Network diagram: Affordances

The figure above summarises the theme Affordances and its two codes. In addition to the summary, the theme and sub-themes also shared related participants' quotations. According to the findings, learners do miss classes due to different challenges like floods and protests and some learners arriving late and only missing the first few lessons now and then. However, there are no organized educational structures that are put in place to provide catching up on those missed classes. Some learners indicated that they rely on others for a catch-up, whereas teachers highlighted that government organizes catch-up only for Grade 12 learners. Some teachers provide some extra lessons to try and catch up on missed classes. If RTOLs could be implemented, teachers and learners would be able to catch up any time of the day, even if there should be any challenges that prevent them from arriving at school on time. This will improve the pass rate. Teachers also indicated that learners learn better using technology, as they are too lazy to carry hard copy textbooks. Some schools have been obtaining a 100% pass rate. The implementation of RTOLs could maintain that 100% pass rate and even improve the quality of the results.

4.7 SUMMARY

This chapter presented the results and interpretation of the findings generated from the qualitative approach. The data was analysed using thematic analysis. Based on the underpinning concept of the duality of structure, major components of the structuration theory were used as a theoretical lens through which the research questions were addressed and answered. The network diagram below portrays the relationships between all the themes covered in this chapter.

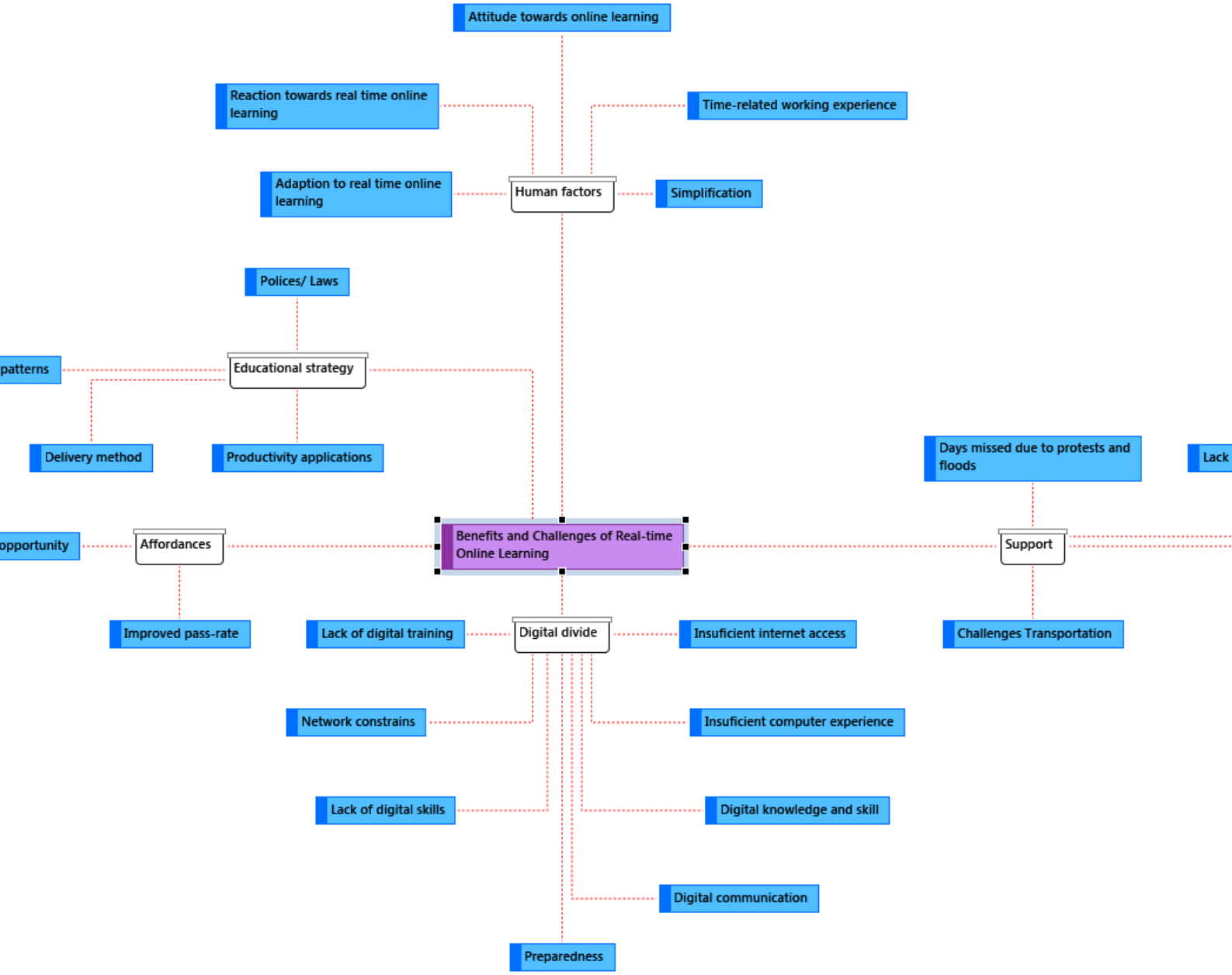

Figure 4.24: Network diagram: Themes and codes

The figure above summarises all the codes derived from the main themes and how each code relates to each main theme. Every code consists of verbatim quotations by participants as evidence that the analysis was based on the statements from the participants. The findings revealed that the majority of the learner participants were aged 15–20, and the teacher participants were aged 25–64. Genders were almost equally represented in the sample. The majority of participants indicated the challenges that come as a result of flooding and protesting, which left them absent from school for a long period. The participants therefore agreed that there is a need for the implementation of real-time online learning in rural areas. However, they also highlighted factors that could hinder the facilitation of RTOLs. The majority of participants were from Venda culture. This could be because the research was conducted in their geographical area.

The findings of this research revealed that even though many factors might prevent the implementation of e-learning technology in Limpopo, it would come with many educational benefits.

5 CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

Whereas the previous chapter presented the analysis and the interpretation of the findings, this chapter presents: reviews of all the previous chapters in Section 5.1; revisiting the research question in Section 5.2; guideline for real-time online learning in Section 5.3; research contribution addressed in Section 5.4; the validity and reliability in Section 5.5; recommendation and future research in Section 5.6; limitations of the study showed in Section 5.7; and Section 5.8 Conclusion which completes the study.

5.1 CHAPTER REVIEW

This section recaps previous chapters:

- Introduction to the research study in Section 5.1.1
- Literature review in Section 5.1.2
- Research design and methodology in Section 5.1.3
- Findings in Section 5.1.4.

5.1.1 CHAPTER 1: INTRODUCTION TO THE RESEARCH STUDY

Chapter 1 explained the following topics and sections:

- The background of the research in Section 1.1
- The statement of the research problem in Section 1.2
- The primary research question, sub-questions, and research objectives in Section1.3
- Research design, research methodology, and research methods in Section 1.4
- Delineation of the research in Section 1.5
- The significance of the research in Section 1.6
- Expected outcomes in Section 1.7
- Limitation of the study in Section 1.8
- Assumptions in Section 1.9
- The contribution of the research in Section 1.10
- Ethical considerations in Section 1.11

- Summary in Section 1.13

5.1.2 CHAPTER 2: LITERATURE REVIEW

In Chapter 2, the literature reviewed, explained the gap that existed. The four themes which emerged from literature sources and drove the formulation of research questions are Digital divide in Section 2.2, Educational strategy in Section 2.3, Human factors in Section 2.4, and Support in Section 2.5.

5.1.3 CHAPTER 3: DESIGN AND METHODOLOGY

Chapter 3 outlined the research design in Section 3.2, the research methodology addressed in Section 3.3, ethical consideration explained in Section 3.4, followed by delimitation in Section 3.5, and lastly, chapter summary in Section 3.6.

5.1.4 CHAPTER 4: DATA ANALYSIS, RESULTS, AND FINDINGS

Chapter 4 analysed the empirical data from the observations, paper-based questionnaires, and semi-structured interviews. An additional theme namely, affordances (Section 4.6) emerged.

5.2 REVISITING THE RESEARCH QUESTIONS

This research study aimed to explore the hindrances and facilitators that inform decisions regarding the implementation of real-time, online learning in a rural context of Limpopo, South Africa. Based on this aim, one research question and two research sub-questions were outlined in Chapter one. Table 1.1 from Chapter 1 is conveniently repeated below, labelled as Table 5.1. It maps the research questions for the objectives of the study.

Table 5.1: Research questions and objectives of the study

Research Questions	Objectives
PRQ: What factors influence the implementation of e- learning technology in rural South Africa?	**MO:** To explore guidelines that inform the implementation of real-time online learning in rural South Africa.
SQ1: What factors could hinder the successful implementation of e-learning technology in the rural areas of Vuwani and Lukalo in Limpopo in South Africa?	**O1**: To identify the factors which adversely affect real-time online learning success in two specific rural areas in Limpopo in South Africa.
SQ2: What factors facilitate the implementation of e-learning technology established in the rural areas of Vuwani and Lukalo in Limpopo in South Africa?	**O2:** To investigate the factors which enable real-time online education in two specific rural areas in Limpopo in South Africa.

Research questions are answered in Section 5.3, where the sub-questions, SQ1 and SQ2 are addressed, prior to a review of the primary research question, PRQ.

5.3 FACTORS FOR THE IMPLEMENTATION OF E-LEARNING TECHNOLOGIES IN RURAL SOUTH

The focus of this study was to explore what factors characterize the guidelines for the implementation of e-learning technology in rural South Africa. Indeed, there are hindrances when it comes to teaching and learning in Limpopo province, particularly in Vuwani and Lukalo. This is due to service delivery protests and long distances that teachers and learners travel with bad road conditions – even during rainy days and heavy floods. Because of the lack of real-time online learning that could be used during protests and heavy floods, learners and teachers find themselves absent from schools

for a long time and this affects teaching and learning badly in Limpopo. The background for the study was obtained by studying the global literature on a topic similar to this in Limpopo, South Africa. The background of this research covers the impact of rain and protests that affected schools academically, its impact on teachers and learners, and how it affects teaching and learning. Flooding, long-distance travelling to schools, and protests were discovered as a challenge for teaching and learning.

Table 5.2 addresses guidelines for real-time online learning. It reflects emergent synthesised categories of themes and sub-themes. Furthermore, it concretises answers to research sub-questions SQ1.1 – Hindrances, and SQ1.2 – Facilitators, as set out earlier in Table 5.1 (Section 5.2). Bracketed items refer to relevant sections in Chapter 4.

Table 5.2: Hindrances and Facilitators linked to themes and sub-themes

Theme	Sub-themes	SQ1.1 Hindrances	SQ1.2 Facilitators
Digital Divide (4.2)	Digital communication (4.2.1)	✓	
	Digital knowledge skills (4.2.2)	✓	
	A need for training (4.2.3)	✓	
	Computer experience (4.2.4)	✓	
	Network constraints (4.2.5)	✓	
	Internet access (4.2.6)	✓	
	Preparedness (4.2.7)		✓
Educational Strategy (4.3)	Delivery method (4.3.1)		✓
	Policies and laws (4.3.2)		✓
	Productivity applications (4.3.3)		✓
	Usage patterns (4.3.4)		✓
Human Factor (4.4)	Adoption (4.4.1)	✓	
	Attitude (4.4.2)	✓	
	Simplification (4.4.3)		✓
	Perception (4.4.4)	✓	✓
	Time-related working experience (4.4.5)	✓	
Support (4.5)	Days missed (4.5.1)		✓
	Distance and time (4.5.2)		✓
	Lack of government involvement (4.5.3)	✓	
	Transportation (4.5.4)		✓
Affordances (4.6)	Catch-up (4.6.1)		✓
	Pass rate (4.6.2)		✓

5.3.1 HINDRANCES

The hindrances associated with this study have been elicited via the literature that was reviewed in Chapter 2, and during analysis of collected data (Chapter 4). These processes were associated with the following sub-question:

SQ1: What factors could hinder the successful implementation of e-learning technology in the rural areas of Vuwani and Lukalo in Limpopo in South Africa?

Similarly, the same hindrances were discovered during data collection and this concreted the legitimacy of SQ1. Finding the answer to this question was done by conducting observations, paper-based questionnaires, and semi-structured interviews in two Cases (Case A and Case B). This was done with participants representing two different schools at different levels, as indicated in Chapter 3. This question was aimed to address the following objective:

O1: To identify the factors which adversely affect real-time online learning success in two specific rural areas in Limpopo in South Africa.

Evidence from Chapter 4 revealed that there have been some educational challenges caused by flooding and protesting which left schools closed for a long time. The evidence from Chapter 4 revealed that there are some educational challenges in the rural areas of Limpopo, particularly in Vuwani and Lukalo, where teachers and learners were severely affected by heavy rains and protests. As a result, there is a need for the implementation of e-learning technology in those rural areas. However, there are factors that could hinder the implementation of RTOLs. The following factors which prevent the implementation of e-learning technology in Limpopo are discussed.

5.3.1.1 Factors associated with the digital divide

There is a gap between those who have access to the internet and those who do not have access. Digital communication could be impossible as a result of internet or poor internet connection and a lack of digital skills and computer experience which could prevent RTOLs. The lack of digital training on how to use digital devices could lead to a lack of preparedness.

5.3.1.2 Factors associated with the educational strategy

How lessons could be delivered online may negatively impact e-learning technology, since there are no policies in place that could govern the usage of RTOLs and gadgets. Some teachers and learners would have difficulty to use some productive applications if there is no digital training provided.

5.3.1.3 Factors associated with the human factor

How people behave, would be another major determining factor of whether the e-learning technology will be a success. Some people believe that it would be difficult for them to adapt. Even though there is a positive attitude towards e-learning technology and it is believed that it would simplify teaching and learning, there is also a perception that some learners might abuse the gadgets and the internet for their own personal use.

5.3.1.4 Factors associated with the support.

The current exclusion of government support from the rural areas would probably be another factor that could hinder the implementation of e-learning technology. There is still an unstable internet connection and an unattainable power supply that would negatively affect the RTOLs. In conclusion, the following factors would hinder the implementation of e-learning technology:

- Lack of government involvement
- Diversities
- Abuse of gadgets
- Attitude towards online learning
- Network constraints
- Lack of discipline
- Reliance on teachers
- Learners' poor work ethics
- Lack of digital skills
- Infrastructure shortcomings
- Internet access

- Unstable power supply
- Lack of digital knowledge and
- Lack of computer experience.

From the data collection and analysis, the findings revealed that the factors above could hinder the implementation of RTOLs if not addressed, and that answered the research sub-question 1.

Figure 5.2 below presents the research sub-question that was raised to see what factors could hinder the real-time online learning systems in the rural areas of Vuwani and Lukalo in Limpopo in South Africa.

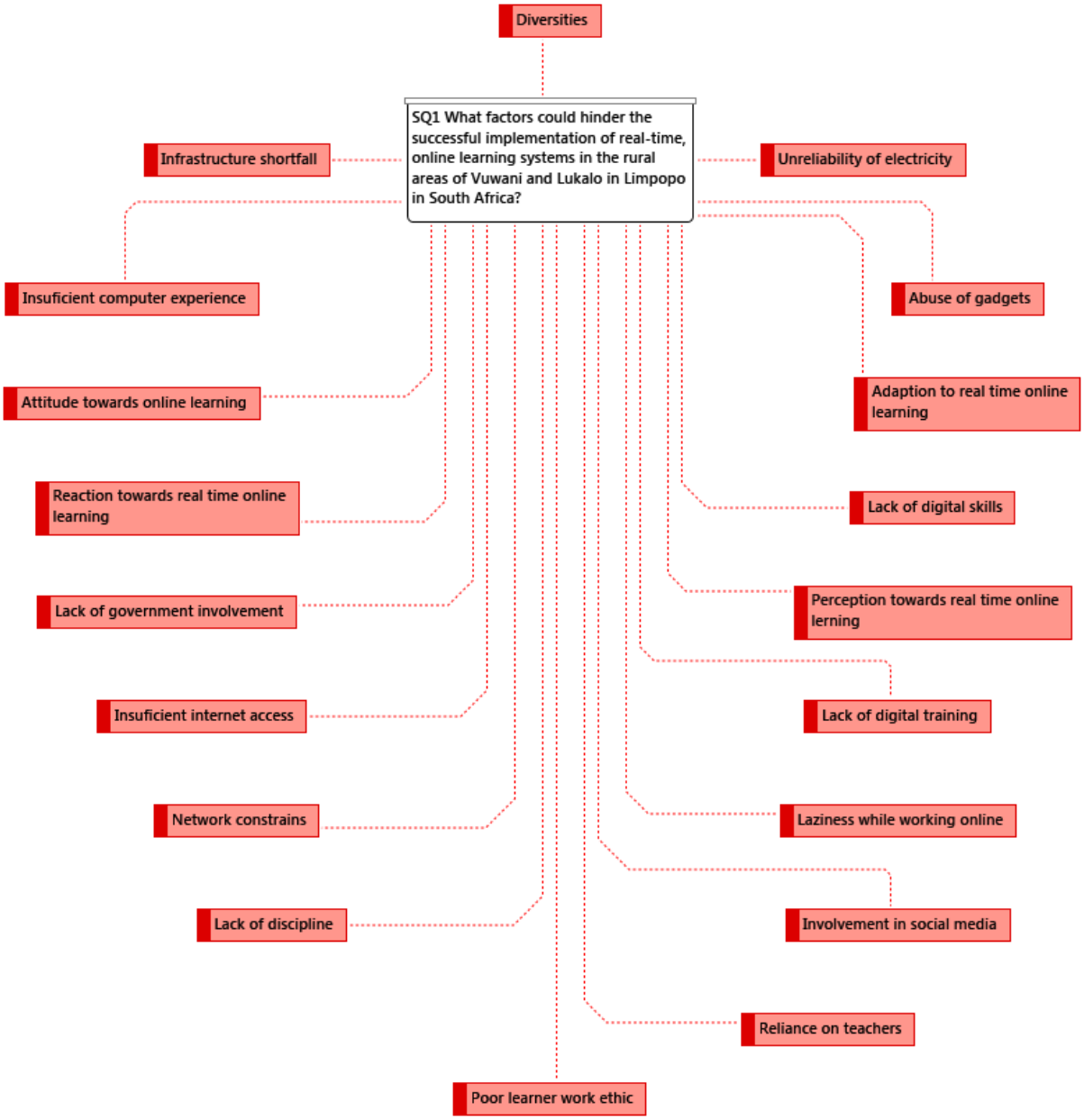

Figure 5.1: Network diagram: SQ1 and concepts

5.3.2 FACILITATORS

The facilitators associated with this study were gleaned from both pertinent reviewed literature (Chapter 2) and analysed empirical data (Chapter 4). This section addresses the following sub-question:

SQ2: What factors facilitate the implementation of e-learning technology established in the rural areas of Vuwani and Lukalo in Limpopo in South Africa?

Similarly, the same facilitators were discovered during data collection and this concreted the legitimacy of SQ2. Finding the answer to this question was done by conducting observations, paper-based questionnaires, and semi-structured interviews in two cases (Case A and Case B). This was done with participants on different levels, representing two different schools, as indicated in Chapter 3. This question was aimed to address the following objective:

O2: To investigate the factors which enable real-time online education in two specific rural areas in Limpopo in South Africa.

Evidence from Chapter 4 reveals that the implementation of e-learning technology could simplify teaching and learning. Challenges that affect teaching and learning during the floods and protect: The majority of the learners walk a long distance to school and as a result, they sometimes miss lessons. The following are influencing factors which could facilitate the implementation of RTOLs in Limpopo.

5.3.2.1 The following factors are associated with the digital divide: Communication, Skills, Training, Experience, and Preparedness

Digital communication would allow communication for both learners and teachers for educational purpose, even during floods and protests. Learners would be able to contact teachers when they seek educational assistance. The implementation of RTOLs will also help both learners and teachers to prepare their lessons and also to keep interacting, and this would close the gap between those who have access to the internet and those who do not have access. Using e..-learning technology will help

learners and teachers to gain more digital skills and computer experience. This would enable digital training for both teachers and learners.

5.3.2.2 The following factors are associated with the educational strategy: Delivery method, Policies and Laws, and Productivity application

Lessons could be delivered online at the learner's convenient time and it would not require travelling during floods and protests. This benefit would influence the usage of some productive application for both teachers and learners, as they would be using some learning management system and different applications to present lessons. This would furthermore improve teachers' and learners' ability to use new technology and thus simplify teaching and learning.

Factors associated with the human factor

The successful implementation of e-learning technology would change people's perception and attitude about the adaption of new technology. This could also help to increase their confidence in learning a new way of simplifying teaching and learning.

Factors associated with the government support

How learners get support after missing some school days, would improve as they will be able to catch up. This will close the gap that is created by the distance between the place of residence and schools and time missed due to travelling. This would also minimize the issue of transportation, as learners would be able to learn from home at their convenient time and that would simplify teaching and learning.

Factors associated with the affordances

When learners and teachers are not able to go to schools during flooding and protests, the pass rate also decreases. The successful implementation of e-learning technology would be a solution for catch-up, when teachers and learners are not able to access school premises and this will increase the pass rate.

In conclusion, the following are the factors that could benefit learners and teachers in Limpopo, should e-learning technology be successfully implemented:

- Ability to use technology
- Continued learning during the protests and rainy days
- Improved pass rate
- Digital communication
- Catch-up opportunity
- Simplification
- Solution to lack of transport
- Online lesson delivery
- Preparedness
- Improved computer skills
- The ability for learners to do research

Therefore, the factors above could influence the implementation of RTOLs if addressed properly, and that answers the research sub-question 2.

Figure 5.2 below addresses the research sub-question that was raised to explore factors that facilitate real-time online learning systems established in the rural areas of Vuwani and Lukalo in Limpopo in South Africa.

Figure 5.2: Network diagram: SQ2 and concepts

5.3.3 SUMMARY

This study identified a gap concerning factors influencing the implementation of e-learning technology in rural secondary schools in South Africa. The study highlighted that e-learning technology viewed as RTOLs implemented in the rural areas of Limpopo would be beneficial and effective if the current hindrances could be addressed. However, the implementation of RTOLs could be possible through government involvement, government support, provision of stable power supply, stable internet access, and dedication of the learners, teachers and principals who will be using this system. Even though the two schools are in different locations, few factors are shared in both cases (Case A and Case B).

Hindrances: comparison of Case A vs Case B

This section summarises emergent hindrances relative to each case.

Limited internet access

Both cases have limited internet access and both cases struggle to have reliable internet connections. Although Case A has a computer lab that learners could use to access the internet, their internet connections are not stable and this results in them being unable to use the internet as they may wish to. Even though the evidence shows that Case B has better internet connections, it does not have a computer lab that learners could use to access the internet, and therefore they are unable to use the internet as they may wish to.

Unstable power supply

Both cases have indicated that there is sufficient constant power supply from Eskom, even though there might be some power cut occasionally. Both do not have any backup plan.

Transportation challenges

Both cases have learners who travel from long distances. However, Case A has a higher rate of learners travelling long distances of up to 50 kilometres, compared to 15

kilometres in Case B. Furthermore, in Case A road conditions are far worse compared to that of Case B.

Digital skills and computer experience

Both cases have an average level of digital skills and computer experience, even though Case B does not have a computer lab. The majority of learners have access to gadgets and that improves their digital skills.

Protests and distribution

Learners from both cases find themselves absent from school due to one challenge or the other. Case A learners are unable to attend schools during floods and that has never affected Case B. However, Case B experiences a lot of protests that cause some learners to be unable to attend schools for three months.

Similarities between Case A and Case B

Both cases are in rural areas, even though Case B is in a better location compared to Case A. Both cases' attitudes towards RTOLs were very positive. The majority of teachers and learners were positive and confident that they could be able to adapt to RTOLs, except for one teacher from Case A who believes that he is too old and who is ready for retirement. People's attitudes and perceptions towards the adaption of RTOLs would also play an important role in the successful implementation of RTOLs. Both cases are keen to learn new technologies and ready to adapt RTOLS. Education and training of new technology is important to learners, teachers, principals, and all who might use the system. Laws and policies to govern the usage of the system will also need to be applied strictly. Furthermore, the researcher observed that for case A the implementation would be simple compared to that of Case B, because Case A has better infrastructures, as they received newly renovated schools with some computer labs. In summary, both sub-questions of this research study has been answered. Figure 5.3 below illustrates two sub-questions and the codes which provide more understanding of the facilitators that support the implementation, as well as the hindrances that may negatively affect the implementation.

Figure 5.3: Network diagram: Sub questions and concepts

The figure above explains how the codes are connected to each sub-question through the red dotted line. Codes in green represent facilitators associated with sub-question1, and codes in red represent hindrances that could hinder the implementation of RTOLs. The next section (5.4) reviews the research contribution.

5.4 RESEARCH CONTRIBUTIONS

This section presents the research contributions: methodological contributions in Section 5.4.1, theoretical contribution in Section 5.4.2, and practical contribution in Section 5.4.3.

5.4.1 METHODOLOGICAL CONTRIBUTION

The qualitative approach and research expanded the information provided for this study, as it included the relevant perception of the participants, their understandings, opinions, explanations, and experiences, based on the field of study. Methodologically, it has assembled strategies from various disciplines to produce a methodical literature review, extending the application of a comparative case study method to explore guidelines for the implementation of a real-time online learning system. This study offers substantive and categorized strategies for all institutional decision makers – strategic, tactical, and operational – regarding best guidelines for real-time online learning for schools in rural areas.

The additional methodological contribution is the type of data analysis methods followed in this study. Content analysis was used to analyse the data generated from the qualitative approach.

5.4.2 THEORETICAL CONTRIBUTION

Before this study little was known about the guidelines concerning the hindrances and facilitators potentially accompanying an RTOL implementation. This study identified and explored this existing gap. Furthermore, the study concretised a framework of factors that serve as hindering and facilitating guidelines to the implementation and to the possibilities of future research. The synthesised foundations identified both via pertinent literature sources and during qualitative data analysis, have the collective

potential to act as a theoretical lens that supports understanding and conceptualization of an important, yet neglected consideration in educational contexts.

5.4.3 PRACTICAL CONTRIBUTION

It extends to understand issues of the hindrances and facilitators associated with the implementation of real-time online learning in rural areas of Limpopo, through an interpretive case study methodology. Participants may use the proposed general framework to explore the usage of real-time online learning in rural areas.

5.5 VALIDITY AND RELIABILITY

The interview questions were accurately measured. The title, aim, summary, and themes of the study were sent to the participants via email a few days before the interview, to enable the participants to be prepared by obtaining the supportive documents.

The following steps were taken to ensure the validity of the collected data:

- Data collected was from John Mutheiwana Secondary School and Milton Mpfumedzeni Secondary School and this validate the source of data collected.
- The interview date and time were selected to make sure that procedures did not influence the data collection process.
- Interview questions were both pre-tested and pilot-tested before the in-depth interviews with the participants were conducted.

5.6 LIMITATIONS OF THE STUDY

The study was limited in several ways. The distance between Cape Town and Limpopo was a big concern, as travelling cost was covered by the researcher. Owing to data-collection restrictions imposed by the Limpopo Department of Education's ethics committee, the timeline between the data collection date and the meeting with the school administrators was also an obstacle. Interviews could not be possible as the school administration had some urgent meeting. Although the case studies comprised a selection of principals (2), school teachers (6), administrators (2), and the students

(26), the sample size was small and not everyone was available for an interview. Financial constraints limited travelling between the Western Cape and Limpopo and access to interview learners was restricted as they were mostly busy with revisions.

Researcher bias could be a problematic issue because the researcher come from the same community, his opinion may have presented bias, how ever data collection was triangulated to avoid biasness as indicated in section 3.2.7.

5.7 RECOMMENDATIONS AND FUTURE RESEARCH

This study forms the basis for future doctoral and post-doctoral research. Furthermore, the findings of this study suggest further exploration of the factors influencing the implementation of e-learning technology. Several avenues are recommended:

- This study only covered two schools in Limpopo, therefore this topic could also focus on other rural areas in South Africa and the findings could be compared. It is recommended that the same topic should be researched in other rural areas of South Africa, which could then be compared to the findings of this research.
- The opinions and experiences of participants could be explored and whether the RTOLs could function effectively.
- This study did not develop and implement any real-time online learning system. This is a pilot study towards my doctoral studies. A system could be developed to test and see if participants could cope and adapt to the new way of teaching and learning.
- Further research is recommended to determine if this group would still share the same opinion after RTOLs have been implemented.

5.8 CONCLUSION

This study identified a gap concerning factors influencing the implementation of e-learning technology in rural secondary schools in South Africa. This study discussed factors that can hinder the RTOLs as well as the facilitators for the implementation of RTOLs. From an educational perspective, the study revealed a gap in the digital divide between participants in two different schools in the rural areas of Limpopo. Human

factors also play an important role to make people believe that they are capable of using a digital device for educational purposes. There is also a need for digital training for those who are willing to try. For the real-time online learning system to solve issues associated with teaching and learning in the rural areas of Limpopo, South Africa, it will greatly depend on the ability of the government to provide full support in terms of well-maintained infrastructures, constant power supply, stable internet collection, sustainable RTOLs with laws and policies in place to govern its usage, and the assurance that there would be adequate training to all participants who will be using the real-time online learning system.

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7 APPENDICES

APPENDIX A – Ethical clearance certificate

P.O. Box 652 • Cape Town 8000 South Africa •Tel: +27 21 469 1012 • Fax +27 21 469 1002
80 Roeland Street, Vredehoek, Cape Town 8001

Office of the Research Ethics Committee	Faculty of Informatics and Design

22 April 2020

Ethics approval was granted to Mr Emmanuel Madzunye, student number 216272599, for research activities related to the MTech: Information Technology at the Faculty of Informatics and Design, Cape Peninsula University of Technology (CPUT).

Title of thesis:	Online, real-time learning systems in a rural area of South Africa

Comments

Research activities are restricted to those detailed in the research proposal.

	22 April 2020
Signed: Faculty Research Ethics Committee	Date

APPENDIX B – Introductory letter for the collection of research data

Cape Peninsula
University of Technology

Introductory letter for the collection of research data

Madzunye Emmanuel is registered for the M Tech (IT) degree at CPUT (216272599). The thesis is titled **Guidelines for the implementation of online, real-time learning systems in a rural area of South Africa: challenges and opportunities** and aims to aims to target particularly real-time, online learning a rural context of Vuwani Secondary School and Milton Mpfumedzeni High School in Limpopo. The supervisor(s) for this research is/are: Prof. Ephias Ruhode and contact his details are: 021 460 3284

In order to meet the requirements of the university's Higher Degrees Committee (HDC) the student must get consent to collect data from organisations which they have identified as potential sources of data. In this case the student will use Interviews to gather data.

If you agree to this, you are requested to complete the attached form (an electronic version will be made available to you if you so desire) and print it on your organisation's letterhead.

For further clarification on this matter please contact either the supervisor(s) identified above, or the Faculty Research Ethics Committee secretary (Ms V Naidoo) at 021 469 1012 or naidoove@cput.ac.za.

Yours sincerely

Prof. Ephias Ruhode

15 August 2019

APPENDIX C – Permission letter LDE

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

Ref: 2/2/2 Enq: Mabogo MG Tel No: 015 290 9365 E-mail:MabogoMG@edu.limpopo.gov.za

Madzunye E
Cape Peninsula
University of Technology
P O BOX 652
CAPE TOWN
8000

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH

1. The above bears reference.
2. The Department wishes to inform you that your request to conduct research has been approved. Topic of the research proposal: **"GUIDELINE FOR THE IMPLEMENTATION OF ONLINE ,REAL TIME LEARNING SYSTEMS IN A RURAL AREA OF SOUTH AFRICA: CHALLENGES AND OPPOTUNITIES."**
3. The following conditions should be considered:

3.1 The research should not have any financial implications for Limpopo Department of Education.

3.2 Arrangements should be made with the Circuit Office and the schools concerned.

3.3 The conduct of research should not in anyhow disrupt the academic programs at the schools.

3.4 The research should not be conducted during the time of Examinations especially the fourth term.

3.5 During the study, applicable research ethics should be adhered to; in particular the principle of voluntary participation (the people involved should be respected).

3.6 Upon completion of research study, the researcher shall share the final product of the research with the Department.

REQUEST FOR PERMISSION TO CONDUCT RESEARCH: MADZUNYE E

CONFIDENTIAL

Cnr. 113 Biccard & 24 Excelsior Street, POLOKWANE, 0700, Private Bag X9489, POLOKWANE, 0700
Tel: 015 290 7600, Fax: 015 297 6920/4220/4494

The heartland of southern Africa - development is about people!

4 Furthermore, you are expected to produce this letter at Schools/ Offices where you intend conducting your research as an evidence that you are permitted to conduct the research.

5 The department appreciates the contribution that you wish to make and wishes you success in your investigation.

Best wishes.

Ms NB Mutheiwana
Head of Department

2017/5/22
Date

APPENDIX D– Consent letter Parents

Sponsor (Parent) Consent

During this data collection the research participants are selected fairly and with no bias. The participants are informed about the research study and asked to provide their approval before they became part of the research, Participants are informed that they have rights to refuse or withdraw. This research study uses confidentiality and integrity of the participants by making sure that their privacy is protected and there is no harm coming from a breach of participants' privacy. The research participants will anonymise.

I declare that I understood the context above and gave the researcher permission to interview my child (learner).

Signature: _____ Date: _____

APPENDIX E– Consent letter Participants

Participant Consent

During this data collection the research participants are selected fairly and with no bias. The participants are informed about the research study and asked to provide their approval before they became part of the research, Participants are informed that they have rights to refuse or withdraw. This research study uses confidentiality and integrity of the participants by making sure that their privacy is protected and there is no harm coming from a breach of participants' privacy. The research participants will anonymise.

I declare that I understood the context above and gave the researcher permission to interview me.

Signature: _____ Date: _____

APPENDIX F – Questionnaires

Q1 What is your age bracket				
Rate the statement selecting ONE option				
	<14	14-15	16-17	18-20
Age	□	□	□	□
Q2 In which grade are you in?				
Rate the statement selecting ONE option				
	08	09	10	11
Grade	□	□	□	□
Q3 What gender are you?				
Rate the statement selecting ONE option				
	Male	Female		
Gender	□	□		
Q4 What do you use to communicate for educational purpose?				
Rate the statement selecting ONE option				
Phone call	Sms	WhatsApp	WeChat	Facebook	None
□	□	□	□	□	□

Q5 There is good educational digital communication					
Rate the statement selecting ONE option					
Strongly Disagree	1	2	3	4	Strongly Agree
	□	□	□	□	
Q6 I have enough digital knowledge and skills for RTOLs.					
Rate the statement selecting ONE option					
Strongly Disagree	1	2	3	4	Strongly Agree
	□	□	□	□	
Q7 I need digital training to be able to use RTOLs.					
Rate the statement selecting ONE option					
Strongly Disagree	1	2	3	4	Strongly Agree
	□	□	□	□	
Q8 I have computer experience that might be needed for e-learning					
Rate the statement selecting ONE option					
Strongly Disagree	1	2	3	4	Strongly Agree
	□	□	□	□	
Q9 The is stable network connection that can enable RTOLs					

Rate the statement selecting ONE option					
Strongly Disagree	1	2	3	4	Strongly Agree
	□	□	□	□	
Q10 There is enough internet access from school or home					
Rate the statement selecting ONE option					
Strongly Disagree	1	2	3	4	Strongly Agree
	□	□	□	□	
Q11 Delivery through RTOLs would be easy and simple					
Rate the statement selecting ONE option					
Strongly Disagree	1	2	3	4	Strongly Agree
	□	□	□	□	
Q12 I would be comfortable with teachers using some productivity application					
Rate the statement selecting ONE option					
Strongly Disagree	1	2	3	4	Strongly Agree
	□	□	□	□	

Q13 There is a need for policies and laws to be implemented to govern learning through RTOLs					
Rate the statement selecting ONE option					
Strongly Disagree	1	2	3	4	Strongly Agree
	□	□	□	□	
Q14 It will be simple to adapt RTOLs if it could be implemented					
Rate the statement selecting ONE option					
Strongly Disagree	1	2	3	4	Strongly Agree
	□	□	□	□	
Q15 All learners would react positively towards RTOLs					
Rate the statement selecting ONE option					
Strongly Disagree	1	2	3	4	Strongly Agree
	□	□	□	□	
Q16 RTOLs would simplifies teaching and learning in rural areas					
Rate the statement selecting ONE option					
	1	2	3	4	

Strongly Disagree	□	□	□	□	Strongly Agree
Q17 RTOLs can never be a solution for issues affecting teaching and learning in rural areas.					
Rate the statement selecting ONE option					
Strongly Disagree	1	2	3	4	Strongly Agree
	□	□	□	□	
Q18 There must be more government support and involvement in rural areas.					
Rate the statement selecting ONE option					
Strongly Disagree	1	2	3	4	Strongly Agree
	□	□	□	□	
Q19 Transportation to school is a problem					
Rate the statement selecting ONE option					
Strongly Disagree	1	2	3	4	Strongly Agree
	□	□	□	□	
Q20 I travel too long distance to school, and I get too exhausted					
Rate the statement selecting ONE option					
	1	2	3	4	

Strongly Disagree	□	□	□	□	Strongly Agree
Q21 Learners always miss classes There is no organised catch-up for missed classes					
Rate the statement selecting ONE option					
Strongly Disagree	1	2	3	4	Strongly Agree
	□	□	□	□	

APPENDIX G – Semi-structured Interviews for Learners

Primary Research Question (PRQ)	What factors influence the implementation of e- learning technology in rural South Africa?
Sub-question 1 (SQ1)	What factors could hinder the successful implementation of e-learning technology in the rural areas of Vuwani and Lukalo in Limpopo in South Africa?
Sub-questions 2 (SQ2)	What factors facilitate the implementation of e-learning technology established in the rural areas of Vuwani and Lukalo in Limpopo in South Africa?
Q1	How long does it take you from your home to school?
Q2	What do you use as the mode of transport to come to schools, and what are the challenges that you encounter?
Q3	How many days were you not able to go to school due to transport issues/ protest?
Q4	How do you catch up on those days' schoolwork?
Q5	Have you used computers for educational purposes before?
Q6	How was the experience when using a computer for educational purposes?
Q7	If RTOL is to be provided, do you think it would be simple to use it and adapt to it?

Q8	What are the hindrances that you think might be encountered if RTOLs is to be implemented?
Q9	How much digital knowledge do you think learners require to enable them to use RTOLs?
Q10	How do you communicate with your classmates after school when you need educational assistance?
Q11	How do you research a subject for an assignment?
Q12	How do you think learners/teachers would react if we were to implement RTOLs?
Q13	IF RTOLs were to be implemented what kind of limitations you might experience and what kind of facilitators do you think will be?
Q14	In your opinion, do you think real-time online learning could be a solution for teaching and learning issues in a rural area? Agree? Why? Disagree Why?
Q15	Based on your opinion, what do you think would be a problem with the implementation of real-time online learning in rural areas?
Q16	How do you access internet connections from home?
Q17	What learning delivery methods do you think could work if RTOLs is implemented?
Q18	In your opinion, how much support is needed from the government to allow the implementation of RTOLs?

Q19	If the government provides the internet, in what ways could be learning and teaching be improved?
Q20	In what ways could RTOLs simplify learning and teaching in rural areas?

APPENDIX H – Semi-structured Interviews for Teachers

Primary Research Question (PRQ)	What factors influence the implementation of e- learning technology in rural South Africa?
Sub-question 1 (SQ1)	What factors could hinder the successful implementation of e-learning technology in the rural areas of Vuwani and Lukalo in Limpopo in South Africa?
Sub-questions 2 (SQ2)	What factors facilitate the implementation of e-learning technology established in the rural areas of Vuwani and Lukalo in Limpopo in South Africa?
Q1	How long have you been a teacher?
Q2	How far is your home to school?
Q3	How many days where your students not able to go to school due to transport issues/protests?
Q4	How do your students catch up on the lost days' of schoolwork?
Q5	Have you as a teacher used computers for educational purposes before?

Q6	How your educational digital skill is experience and to you think that you need some training for us RTOL?
Q7	If RTOL is to be provided, do you think it would be simple for you as a teacher to use it and adapt to it? And your students?
Q8	What are the hindrances do you think might be encountered by teachers if RTOLs is to be implemented?
Q9	How much digital knowledge do you think teachers and learners require to enable them to use RTOLs?
Q10	How do you communicate with your students after school when they need educational assistance?
Q11	How do research and preparation on a subject?
Q12	How would you react as a teacher if RTOLs is to be implemented?
Q13	IF RTOLs are to be implemented what kind of limitations do you think might experience and what kind of facilitators do you think will be archived?
Q14	In your opinion as a teacher, do you think real-time online learning could be a solution for teaching and learning issues in a rural area? Agree? Why? Disagree Why?
Q15	Based on your opinion, what do you think would be a problem with the implementation of real-time online learning in rural areas?
Q16	How do you and students access internet connections from home?

Q17	How do you and students access internet connections from school/work?
Q18	In your opinion, what kind of support is needed from the government to allow the implementation of RTOls?
Q19	If the government provides the internet, in what ways could be learning and teaching improved?
Q20	As a teacher, how do you think RTOLs would improve the pass rate?
Q21	What type of training do you think teachers would need to cope with RTOLs
Q22	What do you think of the delivery method online?
Q23	From teachers' point of view In what ways could RTOLs simplify learning and teaching in rural areas?

APPENDIX I – Semi-structured Interviews for Principals

Primary Research Question (PRQ)	What factors influence the implementation of e- learning technology in rural South Africa?
Sub-question 1 (SQ1)	What factors could hinder the successful implementation of e-learning technology in the rural areas of Vuwani and Lukalo in Limpopo in South Africa?
Sub-questions 2 (SQ2)	What factors facilitate the implementation of e-learning technology established in the rural areas of Vuwani and Lukalo in Limpopo in South Africa?
Q1	How long have you been a teacher or a principal?
Q2	How long does it take you to school?
Q3	What is your mode of transport? And what does the majority of your learners use?
Q4	How many days where your students and teachers not able to go to school due to transport issues/protests? If there was any.
Q5	How do your students and teachers catch up on lost days' of schoolwork?
Q6	Have your students and teachers used computers for educational purposes before?

Q7	How do you think was the experience when using a computer for educational purpose?
Q8	If RTOL is to be implemented, do you think it would be simple to use it and adapt to it?
Q9	What are the hindrances that you think might be encountered if RTOLs is implemented? (Students and teachers)
Q10	How much of digital knowledge do you think teachers and learners require enabling them to use RTOLs?
Q11	How do you communicate with your staff after school for educational purposes?
Q12	How do your students and teachers research a subject?
Q13	How do you think learners and teachers would react if we were to implement RTOLs?
Q14	IF RTOLs were to be implemented what kind of limitations do you think you might experience and what kind of facilitators do you think will be?
Q15	In your opinion, do you think real-time online learning could be a solution for teaching and learning issues in a rural area? Agree? Why? Disagree Why?
Q16	How do you, teachers, and students' access internet connections from home?

Q17	How do you, teachers, and students' access internet connections from school/work?
Q18	In your opinion, how much support is needed from the government to allow the implementation of RTOls?
Q19	If the government provides the internet or RTOLs, in what ways could be learning and teaching improved?
Q20	How do you think RTOLs would improve the pass rate?
Q21	What type of training do you think teachers would need RTOLs to be implemented?
Q22	What policies do you think the government needs to implement to govern the implementation of RTOLs?
Q23	In what ways could RTOLs simplify learning and teaching in rural areas?

APPENDIX J – Code book

Code	Explanation	Hindrances	Facilitator
A need for training	There is need for digital training.	X	✓
Adaption	How simply is it for people do adapt?	✓	X
Attitude	People's attitude towards RTOLs.	✓	X
Catch up	The opportunity for catch up when learner miss classes.	X	✓
Challenges Transportation	Challenges encountered because of transportation to school.	X	✓
Computer experience	The amount of computer experiences that learners and teachers have.	✓	X
Convenient at-home study	The opportunity to be able to study from home at any time.	X	✓
Days missed	The number of days missed due to protests or heavy rains.	X	✓
Delivery method	The type of delivery methods used to deliver lessons.	✓	X
Digital communication	Digital communication used for educational communication.	X	✓
Digital knowledge and skill	The amount of digital knowledge and skills that is sufficient for the usage of RTOLs.	✓	✓
Digital skills	The level of digital skills that is sufficient for the usage of RTOLs.	✓	✓
Distance and time	The distance and time used to travel to school daily.	X	✓
Diversities	The state of teachers and learner to be diverse.	✓	✓

Exhaustion	The state in which learners get physically or mantically tired.	X	✓
Floods	An overflow of water due to heavy rains that exceed limit.	X	✓
Improved quality	The ability to fulfil more quality.		✓
Internet access at school or home	The accessibility of internet either t home or school.	✓	✓
Involvement in social media	The involvement of learners in social media during school time.	✓	X
Lack of discipline	The state in which learners are uncontrollable.	✓	X
Laziness	The state in which learners are unable to try to work hard.	✓	
Missed class time	The period that learners unable to attend classes.		✓
Network constrains	The instability of network	✓	
New age learning excitement	The excitement that learners feel due to learning new things.	X	✓
Pass rate	The level and quality in which learners pass.	✓	✓
Perception	The ability for one to be able to see, hear or became aware.	✓	X
Polices/ Laws	Rules that govern any organisation.	✓	X
Poor work ethic	A state in which learner does not work hard to improve quality.	✓	X
Preparedness	A state of teachers and learners to be able to be prepared.	✓	✓
Previous training	Training acquired prior.	✓	X
Problems	Challenges that effect teaching and learning.	✓	✓
Productivity applications	Applications used by teachers to improve quality and production.	X	✓
Protests	The state of disruption by community.	X	✓

Rainy weather	Rain that exceeds the normal limit.	X	✓
Reaction	How one reacts over a situation or recovery.	✓	✓
Simplification	State of simplifying things or situation.	X	✓
Simplification of teaching and learning	State of simplifying teaching and learning for better understanding to learners.	X	✓
Time-related working experience	The amount of time and experience that teachers have.	✓	✓
Usage patterns	How learners and teachers use their devices.	✓	✓
Wasted time	The amount of time wasted due to protest or rain.	X	✓

APPENDIX K – Chapter 2 Reference table

Theme	Link to Sources
Digital divide	Bray, M. and Lillis, K. eds. 2016. *Community Financing of Education: Issues & Policy Implications in Less Developed Countries (Vol. 5)*. Elsevier. Chiang, K.P. & Dholakia, R.R. 2003. Factors driving consumer intention to shop online: An empirical investigation. *Journal of Consumer Psychology*, 13(1–2): 177–183. Clayton, K. & Murphy, A. 2016. Smartphone use as tool for learning. The National Association for Media Literacy Education's Journal of Media Literacy Education, 8(22): 99–109. Deursen, A. & van Dijk, J. 2019. Determinants of Internet skills, uses and outcomes. A systematic review of the second- and third-level digital divide. *Telematics and Informatics*, 34(8): 1607–1624. http://dx.doi.org/10.1016/j.tele.2019.07.007. Deursen, A. & van Dijk, J. 2019. Determinants of Internet skills, uses and outcomes. A systematic review of the second- and third-level digital divide. *Telematics and Informatics*, 34(8): 1607–1624. http://dx.doi.org/10.1016/j.tele.2019.07.007. Fairlie, R.W. 2014. UC Santa Cruz. Heeks, R. 2019. The ICT4D 2.0 Manifesto: Where Next for ICTs and International Development? Helsper, E.J. & Reisdorf, B.C. 2017. The emergence of a "digital underclass" in Great Britain and Sweden: Changing reasons for digital exclusion. *New Media and Society*, 19(8): 1253–1270. Hillier, M. 2018. Loh, Y.A. & Chib, A. 2017. Digital Divide and Employability : ICT Skills for Appropriation. , (June). Letseka, M., Letseka, M.M. & Pitsoe, V. 2018. The Challenges of E-learning in South Africa. In *Trends in E-learning*. InTech. http://www.intechopen.com/books/trends-in-e-learning/the-challenges-of-e-learning-in-south-africa 9 June 2019. Loh, Y.A. & Chib, A. 2017. Digital Divide and Employability : ICT Skills for Appropriation. , (June). Lutz, C. 2019. Digital inequalities in the age of artificial intelligence and big data. , (February): 141–148. Martin, A. & Grudziecki, J. 2015. DigEuLit : Concepts and Tools for Digital Literacy Development. , 7507.

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