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Innovative Communication Protocols for Teaching in Rural Secondary Schools

BY

Minenhle S. Madida

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ETHICAL STATEMENT BY RESEARCHER

I, Minenhle Senzile Madida, hereby declare that the work that I present in this thesis is based on my own research and that I have not submitted this thesis to any other institution of higher education to obtain an academic qualification.

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Signed

<u>10 December 2018</u>
Date

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I would like to thank God Almighty for giving me the wisdom to complete this study. Indeed, I can do all things through Christ who strengthens me.

A sincere thank you goes to my supervisor, Dr. Naidoo and co-supervisor Prof Rugbeer. This thesis was only made possible because of their guidance and tireless support.

The participation of the respondents is what made this thesis a success.

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DEDICATION

This dissertation is dedicated to my mother for her unwavering support and her love that keeps me going. The Lord knows how grateful I am for all her sacrifices that gives me hope for a brighter future. To my brother, Siyanda; like the great Nelson Mandela once said "it always seems impossible until it is done", may this, therefore, be a reminder that hard work and perseverance is the road to success.

ABSTRACT

INNOVATIVE COMMUNICATION PROTOCOLS FOR TEACHING IN RURAL SECONDARY SCHOOLS

By: Minenhle Senzile Madida

The enhancement of the quality of education through the digitisation of the learning systems is a national priority in South Africa and beyond. Some academic institutions, both basic and higher level, have responded to this by adopting the use of ICT in their practice. However, the enormous digital divide between urban and rural areas has escalated with its negative effect on the schools. Most rural schools remain underdeveloped with a huge deficit in teaching and learning resources, while technological progressions continue at an unprecedented speed. These advancements in technology come with drastic changes in all spheres of life, particularly in the labour market. Thus, the need for preparing high school learners with relevant skills for the future, which mostly relies on ICT capabilities. This study, therefore, focuses on how the use of ICT in a rural classroom can help bring the learners to speed with the digital revolutions we are witnessing. The study adopts the Technology Acceptance Model as well as the Interactive Model to propose plausible solutions. The data were collected from 121 rural secondary school teachers in the King Cetshwayo District Municipality. The findings of the study revealed that the lack of ICT skills among teachers, and insufficient resources to support classroom experiences are key barriers to the effective use of innovative communication protocols, which include ICT in the rural classroom. This has policy implications for the department of higher education in terms of human resource development and the provision of appropriate logistics.

WRITING CONVENTIONS

The following conventions are used in this study:

The abbreviated Harvard style of referencing in this study, for example, Hindi et al. (2004:13), meaning Hindi, Miller & Catt 2004 page 13.

Illustrative tables and figures are all given as Figures 1 and Tables 1 in their chronological sequence of appearance.

The World Wide Web (www) is transient and ever changing, therefore one should expect that websites from which information is gathered will be offline or may alter the contents of the website over a period of time.

In instances where the electronic document has been downloaded from a website, the author is mentioned, followed by the year as in Szabo (2010).

This thesis adopts the South African English writing style.

ACRONYMS

AI:	Artificial Intelligence
4IR:	Fourth Industrial Revolution
5IR:	Fifth Industrial Revolution
ICT:	Information and Communication technology
KCDM:	King Cetshwayo District Municipality
KZN:	KwaZulu Natal
LMS:	Learning Management System
NBI:	National Broadband Initiatives
PEOU:	Perceived Ease Of Use
PU:	Perceived Usefulness
TAM:	Technology Acceptance Model
TRA:	Theory for Reasoned Action

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ORIENTATION

1. Introduction

This chapter lays a foundation of the entire study and introduces the main theme of this research. The discourse is tackled from a communication perspective, employing communication strategies to find possible solutions to the discussed. This chapter is a synopsis of this research, detailing the significance of the study, the problem statement, the aims of the study, identifying the gap in the current knowledge and what the study hopes to achieve. Furthermore, the methods and procedures employed by the researcher in conducting this study are also highlighted in this chapter; also, the limitations of the study and ethical considerations are discussed. The focus of the study is on how the use of innovative communication protocols, Information and Communication Technology (ICT) can enhance classroom experiences in underprivileged rural schools.

According to Kerenidis (2015) the word "protocol" is often associated with rules or a system. Whereas, Nguyen (2015:19) defines communication protocol as a system of rules that enables communication between two or more entities of a communication system to transmit information through any kind of variation. Thus, the definition of communication protocol in the context of this study. On the other hand, Bellini *et al.* (2016:49) note that ICT has become a necessity in recent times and it is widely used in almost all spheres of life, with an increased dependence on it. The introduction of the Fourth Industrial Revolution, that digitalizes human physical space has also forced technology into human lives (Schwab, 2016; Mckenzie, 2017). As a result, the digitisation of learning systems for the enhancement of the quality of education has become a priority in the country and beyond (Osakwe *et al.,* 2017:16). However, there is a gap that remains in the use of ICT in schools (Litheko, 2012; Tire & Mlitwa, 2015), which could be explained by various factors that include teachers' perceptions which influence the use of ICT for educational purposes. Thus, the study

investigates rural secondary school teachers' perceptions of the use of ICT for classroom instruction.

2. Motivation for the Study

The issue of poor learner performance, especially the continuous drop of matric pass rate is a serious concern to the society and the education ministry since the improvement of education is a national priority. The findings of the study conducted by Adukaite *et al.* (2017:180) reveal that there is a strong consensus that ICT has the potential to contribute meaningfully to learner performance. While efforts have been invested in ensuring that the schools benefit from ICT, there is a huge gap that remains in the distribution of these resources (Litheko, 2012:13), thus resulting in a difference in learner performance. In 2016 academic year, the KwaZulu-Natal (KZN), Limpopo, and Eastern Cape Provinces were flagged as the poorest performing provinces. In trying to explain the unsatisfactory matric results in KZN Province between the academic years 2013-2016, the lack of infrastructure and study material appeared to be the key factors influencing the decline in results (KZN Annual Report, 2015; Mail & Guardian, 2017). Thus, the significance of investigating the influence of teaching-aids in learner performance is highlighted. This study will investigate possible factors that can explain the unsatisfactory learner performance in secondary schools. In addition, the study attempts to introduce communication strategies that can be implemented for the enhancement of the teaching and learning processes, in order to improve learner performance in secondary schools within the King Cetshwayo District (KCDM). Moreover, the researcher will study the communication style used in rural classrooms and its effect on learning outcomes. Furthermore, the study will investigate how the use of new communication tactics in the classroom could enhance the learning experiences of pupils in underprivileged secondary schools.

3. Statement of Problem

Technology has been proven to be a powerful tool that has the potential to enhance teaching and learning experiences. However, there is an uneven distribution of facilities in schools, as schools in rural communities are receiving unsatisfactory "rural education". Teachers in rural schools are forced to work with limited or no resources. In some instances, the facilities are made available but incorporating it into the curriculum has been one of the factors affecting its effective use, and a challenge to teachers. Previous studies that have been conducted on the use of eLearning to improve learner performance, seem to have given much attention to equipping classrooms with media facilities and have overlooked the facilitators' perspective (Mathevula & Uwizeyimana, 2014; Uluyol & Sahin, 2016; Zyad, 2016; Al-eidan, 2017).

The literature reviewed shows that previous studies on the improvement of learner performance have not given enough attention to the teachers' perspective; as to how the changes brought by ICTs in the classroom affect their teaching experiences. Moreover, there is limited research that includes rural schools (Litheko, 2012:3). Furthermore, the quest for quality education is a problem facing our country, nationally. There are many needs to be addressed for education to improve, especially in rural schools. Therefore, this study attempts to address one of the following needs which focuses on the effective use of ICT for teaching.

The core question for this study is:

> *Can Innovative Communication Protocols positively influence teaching in rural secondary schools?*

4. Aim of the Study

The aim of this study is as follows:

To investigate how the use of Innovative Communication Protocols in the classroom can assist teachers in rural secondary schools.

5. Research Objectives

The objectives of this study are as follows:

i. To examine the extent of communication technologies being used among teachers in rural secondary schools.

ii. To determine the teachers' perceptions towards the use of new communication protocols for instruction within rural classrooms.

iii. To investigate factors affecting the effective use of new communication protocols in rural secondary schools.

6. Research Questions

1. To what extent are rural secondary school teachers exposed to communication technologies?

2. How do secondary school teachers perceive the use of new communication protocols for rural classroom instruction?

3. What are the factors affecting the effective use of new communication protocols in rural secondary schools?

7. Research Methodology

Blanche *et al.* (2006:6) define research methodology as a science of organising research which details techniques employed in studying the research problem. Blanche *et al.* (2006:70) note the importance of the methodology of the research, stating that it ought to be systematic, justifiable and most importantly answer the research question. Brynard *et al.* (2014:38) maintain that research methodology serves as a guide that helps the researcher in making decisions and the entire processes pertaining to the study. Kothari (2004:8) adds that research methodology evaluates research decisions before implementing them and helps the researcher to critically select the most suitable procedures for the study. There are various

research methodologies and techniques. This study will employ both quantitative and qualitative research methods.

8. The quantitative research method

The quantitative research method is famous for its statistical presentation of data. The quantitative research uses surveys or test reports to gather data (Saldana & Omasta, 2018:143). In this study, the survey method of data collection will be employed. According to Beaudry & Miller (2016:107), surveys are effective in measuring attitudes, perceptions, interpretation or preferences of the study subjects. Singh & Sahu (2016:57) affirm that the survey method of collecting data includes the questionnaire as an instrument for gathering data.

9. The qualitative research method

According to Adams & Lawrence (2015:78) qualitative research method uses language to present data. Qualitative research is associated with descriptions and interpretations of participants' perceptions and experiences (Walliman, 2018:148). Denzin & Lincoln (2011:418) posit that the qualitative approach is flexible and explorative. Thus, enabling the researcher control to summarise and formulate explanations. As a result, the researcher is able to solicit rich information that leads to deeper understandings (Adams & Lawrence, 2015:140).

10. Demarcation and Limitations of Study

Financial restrictions will limit this study to cover limited schools in restricted areas (Empangeni and surroundings), limiting the study to a single district and province. The future approach to a study of this kind may consider extending the study to include other districts in the province and possibly other provinces.

11. Intended Contributions to the Body of Knowledge

Learner performance does not concern only teachers and parents but extends much further. The underachievement of learners concerns society as this excludes learners from enrolling in universities, which limits their employment chances, and this becomes a problem for the family, society and the nation. This study intends on investigating the teachers' views on their classroom experiences and possibly suggests strategies that can be implemented in improving teacher and learner experiences.

Findings of this study will be availed to the King Cetshwayo education ministries with the aim of assisting in enhancing classroom experiences. The researcher will speak to the KZN Department of Basic Education to scrutinize what goes on in the classroom and take into consideration the teachers' classroom needs that could enhance teaching and learning experiences.

12. Ethical Requirements

Although the researcher may select the participants of the study for accuracy, it remains essential and ethical that the researcher is granted permission to conduct the study (Brynard *et al.,* 2014:43). For the purposes of this study, the researcher requested permission from the Department of Basic Education as well as from the school principals. The survey authorization letters were sent prior to the study, seeking permission to conduct the study. In addition, this research ensured the protection of the welfare of the participants by collecting data only when permitted and maintain confidentiality. Confidential information of participants, such as their age, was not disclosed to a third party and was only used for research purposes. This research was, therefore, conducted with scholarly integrity and excellence, taking into consideration the guiding principles for research in general.

13. Overview of Chapters

Chapter Two: Discusses literature review pertaining to the current study. The chapter discusses literature inclined with the objectives of this study and covers the extent of ICT usage among teachers, teachers' attitudes and beliefs about the use of ICT for instruction delivery, and the factors that impend the use of ICT for teaching purposes. Furthermore, the chapter brings in the perspective of the Fourth Industrial Revolution and its impact on education.

Chapter Three: Entails the conceptual framework of the study. Two models will be discussed in tackling the matter at hand in a communication perspective.

Chapter Four: Focuses on the research methodology of the study. The chapter discusses the methods and procedures employed by the research in conducting this study. Sampling and data collection instrument will also be discussed in this section. The chapter concludes by explaining how a statistical analysis software called IBM SPSS Statistics will be used to analyse data.

Chapter Five: Deals with the analysis and interpretation on data. This chapter gives meaning to data gathered. The findings of the study are presented in a form of tables and graphs, with supporting literature.

Chapter Six: This is a final chapter of the study that pertains final conclusions and recommendations for future research. The chapter gives the summary of the findings and aligns these findings to the objectives of the study in order to check whether these objectives were met.

14. Conclusion

This chapter has given orientation to the entire study. The chapter has also discussed the motivation that drove this study, including the aim and objectives that guide this study. A brief overview of the study design, the significance of the study, as well as ethical considerations have also been highlighted in this chapter. The following chapter discusses the literature pertaining to this study based on the objectives of the study.

C h a p t e r   2

LITERATURE REVIEW

2. Introduction

The previous chapter provided the orientation for this research. This chapter provides literature that focuses on Information and Communication Technologies (ICTs). ICTs have brought a significant impact on our daily lives by creating various forms of sharing and distributing information (Farmery, 2014; Pavel *et al.,* 2015). The rapid growth of innovative technologies has made ICTs relevant to human life and have reshaped the way information is shared. ICTs include communication tools such as radio, television, telephone, cell phone, fax, computers and the Internet media that enables the management and dissemination of knowledge and information across the globe (Chetley *et al.,* 2006; Ajayi *et al.,* 2018; Gerster & Zimmermann, 2003; Miller *et al.,* 2006; Zuppo, 2012; Dzansi & Amedzo, 2014). The information disseminated through these electronic media have to a large extend enhanced peoples' lives in various sectors, including educational institutions (Onofrei & Iancu, 2015:130). According to Kaur (2013:612), generally, schools have taken advantage of ICT developments, and this has brought about a blended form of learning. Alt (2018:149) for instance, observed the classroom environment in the 21st century and noted that lately classroom environments have evolved into technology-enhanced learning spaces that promote learner engagement in classroom processes (Sein-Echaluce *et al.,* 2017:597). Vitanova *et al.* (2015:1091) however, note the opposite with rural schools. Most rural schools remain underdeveloped with very limited teaching-aids to support learning. Mutua & Ng'eno (2016:32) also add that blended learning has been introduced, but unevenly. Rural schools, mostly, lag behind in ICT developments (Tire & Mlitwa, 2015: 150).

Manwaring *et al.* (2017:22) defines blended learning as a combination of new communication technologies and traditional teaching and learning measures for classroom instruction. Educational institutions have taken steps in improving the quality of education by adopting media technologies, and merged it into existing classroom practice in order to bring positive change in teaching and learning processes. Watson (2001:251) also maintains that the innovation of new communication protocols is a "catalyst for change". Noor-ul-amin, (2013:40) is also consistent with Watson that technology developments continues to modernise our living spaces. Evidence of this is the changes we experience today in the workplace, home, and educational institutions, where technology has brought a significant difference. These transformations have resulted in the creation of new possibilities for communication and knowledge sharing (Wilson *et al.,* 2015:67).

Fidalgo-Blanco *et al.* (2017:717) studied the use of communication technologies for classroom instruction and note that technology-enhanced pedagogies enable learners and their teachers to be involved in the productive sharing of information which has the potential to improve the quality of education. Thus, many academic institutions have adopted different kinds of communication technologies to enhance their practices (Taha, 2014:11).

2.1 The use of Technology in the Classroom

According to Umar & Hassan (2015:2016), computer technologies have become a necessity in the 21st century, and it is widely used in almost all spheres of life to improve the style of living. The academic community has also realised this enormous power of ICT and has adopted it to enhance their functioning. Canada, for instance, is reported to have the majority of schools using computer technologies and the Internet for classroom instruction (Nolan & McBride, 2014:597). Caird & Lane (2015:65) also noted that the UK has improved the quality of education thorough the use of ICT for instruction. Furthermore, Osakwe *et al.* (2017:21) investigated teachers' and learners' perceptions on the use of innovative technologies for academic purposes in Namibian secondary schools and found

that technology is a useful classroom tool. The effectiveness of ICT in education has, therefore, been noted globally.

Thus, most academic institutions have adopted it for the enhancement of classroom experiences. Von der Embse *et al.* (2016) and Moyo & Mavodza (2016) both argue that the education status of the African continent is in crisis, and could be rectified by the use of ICT for classroom instruction. Heyneman (2016:108) sustains that African learners are internationally incompetent due to the discrepancies in teaching and learning resources between Africa and other developed countries. This denotes that there is a relationship between teaching aids and learner performance. Tire & Mlitwa (2015:144) are also in agreement with the relationship between learning resources and learner performance; they maintain that learners who are exposed to ICT perform better than those who are not exposed to ICT. This could be explained by the ability of ICT to evenly provide rich information that contributes to the enhancement of learner performance across the globe, which makes ICT an effective teaching and learning tool. However, ICT access remains a challenge in most rural areas, and this has a direct impact on the limited extent of ICT usage. Conradie *et al.* (2003:2) evaluated the impact of digital divide in the development of deep rural areas in South Africa and discovered that the Internet usage in South Africa remains persistently low due to access provision and ICT-related development actions in rural areas, which have continued to fail due to challenges that include the lack of supporting the infrastructure (Mutua & Ng'eno, 2016:32). Tambotoh *et al.* (2015:179) adds that the extent of ICT usage in rural communities is usually hindered by constraints that include computer skills and affordability. In addition, findings of the study conducted by Wastiau *et al.* (2013:16) reveal that the extent of ICT usage among teachers remains limited due to factors such as the lack of accessibility, which then influences the frequency of ICT use among teachers (Umar & Hassan, 2015:2016). Therefore, it can be concluded that the accessibility of ICT resources has a direct influence on the use of ICT among teachers.

2.2 ICT Access and Skills

According to Andoh-Baidoo *et al.* (2014:3), poor ICT access in most African countries is as a result of low and inconsistent availability of energy, among many factors. Most African countries are at the infancy stage of development and some areas are still lacking basic infrastructure, for example electricity. The lack of electricity in most rural areas has been identified as one of the challenges that excludes rural communities from ICT access. Krauss & Turpin (2010:9) studied the use of ICT for development in deep rural KZN province in South Africa and reported the "development divide" that exists in the country. The uneven distribution of ICT resources is one form of development divide that separates the rural from urban areas, and this divide further extends to the schools situated in these communities. Tamayo *et al.* (2017:112) also observed the difference in educational resources between urban and rural schools. While urban schools enjoy the comfort of this modern teaching-aid that keeps them current and relevant for the future (Chingona *et al.*, 2010:21), sadly, the opposite can be said about rural schools (Erdiaw-Kwasie & Alam, 2016:220). Most schools have upgraded to digital educational resources for classroom instruction, but these resources are unevenly distributed among schools (Rao & Ye, 2016:609). This, however, amplifies the digital divide that already exists between rural and urban communities. According to Novotný *et al.* (2015: 27), rural areas can be defined as isolated and underequipped areas (Ratcliffe *et al.*, 2016:2). Schools in these communities are most likely to experience different learning conditions, in terms of the availability of teaching-aids, as compared to their urban counterparts. The availability of education resources is mostly influenced by the availability of basic infrastructures, such as electricity and extends to the facilities, broadband and Internet connections (Kale & Goh, 2014; Zyad, 2016). Thus, the extent to which rural communities, including rural schools, are exploring ICT is hindered by the inaccessibility of ICT resources (Wastiau *et al.*, 2013:16). In addition, Tire & Mlitwa (2015:144) coincide with Avery (2013:29) that rural schools still lag behind in the digitization of teaching and learning systems, due to limited ICT access

that is directly influenced by underdevelopment. The developments that exist in urban communities extend to their schools and afford learners with opportunities needed to compete in the global market, while the opposite can be said about rural schools. According to Autor & Dorn (2013:1553), ICT skills are now key to the current globally competitive world. Lately, ICT skills have become the driving force of all development aspects. Therefore, it is imperative that schools are ICT capable in order to stay relevant in the future.

Nevertheless, the lack of ICT skills, mostly in rural communities, remains a challenge that influences its usage in these communities. Adu (2016:1733) posit that rural communities are still left out in ICT-related developments and this exacerbates the technology gap between rural and urban communities. As a result, most disadvantaged communities find ICTs predominantly irrelevant to them because of the unaffordability, which is a key barrier and contributes to the present digital divide in the country (Hanafizadeh *et al.,* 2013:48). That is, the usefulness of ICTs in the society and in schools is usually influenced by the availability of the resources. Because education is the driving force of all development (Khatete *et al.*, 2015:371), the effective use of ICT in society is, therefore, dependent on its effective use in academic institutions (Wilson-Strydon & Thomson, 2013:1). This suggests that the availability of technology resources in schools, including rural schools, impacts on the usage and can further minimize the divide in the country. However, a number of studies reviewed, indicated the inequalities in the provision of educational resources (Chingona *et al.*, 2010; Avery, 2013; Tire & Mlitwa, 2015). Masino & Niño-Zarazúa (2016:58) maintain that the provision of educational resources in schools impacts on the learner outcome. Thus, the uneven distribution of these resources in schools creates a difference between rural and urban education. Heyneman (2016:108) sustains that teaching and learning resources play a vital role in learner performance. Ndlovu & Lawrence (2012:18) add that learners from well-equipped schools, mostly urban, usually show competence over learners from rural schools due to the discrepancies in educational resources. Learners from schools equipped with the 21stcentury classroom aids acquire

much-needed skills and competencies that make them competent in this evolution (Siddiq *et al.*, 2016:69). Ramirez *et al.* (2018:951) also note the need to integrate ICT into education in order to meet the needs of the changing times that require new skills and competencies.

Mckenzie (2017) explored the changes brought by technology in human living spaces. The study indicated that technology continues to evolve in a manner that changes the way we function in various aspects, including education. The evolution of technology has ushered the world into the digital revolution that suggests the digitization of functioning, and again, the education sector is no exception. As a result, changes in technology have brought massive dislocations that need 21stcentury skills and competencies. Academic institutions, therefore, have a tremendous role to play in ensuring the acquisition of these skills (Deloitte, 2018:11). Therefore, the digital revolution, also known as The Fourth Industrial Revolution, has a direct impact on education. Educational sectors should, therefore, be prepared with the appropriate skills to better exploit opportunities brought by the revolution. In the South African context, the minister of Basic Education, Ms Angie Motshekga placed a strong emphasis on the role that educational institutions need to play in preparing for the revolution. The minister highlighted that technology skills have become a demand for global competency, thus the importance of enforcing ICT literacy in primary and secondary schools (EWN, 2018). In addition, the current president of the country, President Cyril Ramaphosa, also alluded that the prosperity of the country heavily depends on its ability to capitalize on technology innovations; adding that agility and adaptability in the speed of innovations will help move the country forward (EWN, 2018). This suggests that The Fourth Industrial Revolution has the potential to provide a number of opportunities, but the key to fully grasping these opportunities lies in the skills competition. Therefore, academic institutions need to change and start providing learners with the 21stcentury skills that will produce relevant graduates for the digital era.

2.3 ICT for Instructional Delivery: Teachers' Perspective

Teachers play a central role in classroom activities. They decide the teaching method that best suits them for instructional delivery. Therefore, their perceptions towards the use of ICT in education should be taken into consideration for it to succeed. According to Cazan *et al.* (2016:262), the success of ICT usage for teaching and learning experience is embedded in teachers' attitudes towards ICT. Sherman *et al.* (2012:2098) add that teachers' attitudes and beliefs towards ICT pedagogies are a key determinant to its usage in the classroom. Inan & Lowther (2010:941) evaluated the determinants of ICT integration in the classroom and reported that teachers are the drivers of classroom proceedings, therefore, any changes in their practice concern them, and so does ICT in education (Sherman & Howard, 2012:2098). It is, therefore, important to understand their attitudes and beliefs towards ICT and possibly shape these beliefs for the benefit of teaching and learning outcomes.

A number of studies reviewed concluded that teachers share opposing views towards the use of ICT for instructional delivery (Garland, 2010; Yunus *et al.*, 2013; Ravizza *et al.*, 2014; Mutua & Ng, 2016; Palomino, 2017). A commonly noted concern shared by most of the teachers about the use of ICT in their professional practice was the lack of ICT skills among teachers. Findings of the study conducted by Sabzian & Gilakjani (2013:71) showed that the teachers are concerned and uncomfortable with using computer technologies in the classroom. One reason that could explain this is that teachers find it challenging to embrace technology in the presence of students who are efficient and can use technology quite easily. This was explained by what Naidoo *et al.* (2013:84) referred to as "digital natives". The term digital native was coined by Prensky (2001) to explain the kind of generation that is surrounded by technology at birth (Brown & Czerniewicz, 2010; Wastiau *et al.*, 2013; Kirschner & De Bruyckere, 2017). This group of pupils are very familiar with computer technologies to an extent that their lives revolve around ICT, whereas on the other hand, their teachers who are expected to deliver instruction to them using ICT, are what can be

called digital immigrants (Kale & Goh, 2014:43). These teachers, therefore, find it challenging to even attempt to use ICT in the classrooms because they fear that their learners know more about ICT than they do. As a result, their perceptions towards the use of ICT for teaching are most likely to be influenced by these circumstances (Gibson *et al.*, 2014:170). Also, a number of teachers expressed their feeling of agitation with ICT usage in the classroom due to what they see as threats associated with the use of ICT (Schroeder *et al.,* 2010; Perrotta, 2013; Šimandl & Vaníček, 2017). In general, the advancements in technology have raised job security concerns in the industry (Frey & Osborne, 2013:42), and also in the field of education (Mutua & Ng, 2016:36). According to Marzilli *et al.* (2014:13) teachers who are not computer proficient are reluctant in embracing ICT in their profession because they feel that technology poses a threat to their jobs.

Hsu (2017:27) assessed teacher's ICT proficiency and integration among Taiwanese teachers and reported that teachers generally value ICTs. However, teachers showed concern with the use of ICT in the classroom. The study reported that the underutilization of ICT resources by some teachers was associated with their fear of learners becoming victims of cyberbullying, Internet addict and being exposed to pornographic contents (Strasburger & Hogan, 2013:959). Teachers were more concerned about the improper use of ICT that would yield negative implications to the learners and result in them falling behind with their studies. Mitzner *et al.* (2010:11) and Gaudreau *et al.* (2014:248) share the same view that some teachers consider ICT as strictly for entertainment purpose, therefore the introduction of ICT in the classroom would be an unnecessary disruption that would shift the learners' focus. Because media is known for gamification purposes and as a source of entertainment, teachers then worry that learners might focus more on the playfulness aspect of ICT, which will in turn weaken their performance. Findings of the study conducted by Prestridge (2012:454) also revealed that some teachers are not at ease with the use of ICT for teaching and learning purposes. Some of the teachers interviewed in this study highlighted that ICT may put learners' literacy and numeracy skills at risk. The growing concern among teachers is that ICT simplifies almost everything, while

learning needs to challenge the mind. Furthermore, Smith (2013:80) argues that computer-assisted pedagogies lack face-to-face interaction, which is valued by the teachers as they believe that it allows them to understand the learner's mind (Tayebinik & Puteh, 2013; Copriady, 2015).

Other authors, however, noted contrasting views (Göktaş *et al.,* 2009; Ottenbreit-leftwich *et al.*, 2012; Adukaite *et al.*, 2017; An & Reigeluth, 2011; Burnett, 2010). According to Petko (2012:1353), human behaviour is sometimes informed by their beliefs. In relation to teachers' views on the use of ICT in the classroom, Petko (2012) reported that teachers' choice of ICT integration in their classroom practice is usually influenced by factors associated with personal beliefs. The study found a correlation between ICT competency and usage. This suggests that the teachers are most likely to implement ICT in their classroom practices if they are confident with their own ICT skills for pedagogic use. As a result, teachers' ICT competencies influence their perceptions towards technology-enhanced pedagogies. An analogous study conducted by Mwalongo (2011:42) also explored teachers' attitudes and beliefs towards the use of ICT for classroom instruction in Tanzania. The study revealed that similar studies that have been conducted previously have overlooked teachers' perspective on the subject; while teachers play a pivotal role in classroom activities. Findings of the study revealed that most teachers maintained that ICT is an invaluable teaching and learning tool that has the potential to provide meaningful learning. Teachers find the ability of technology to provide access to a wide range of information very useful and fruitful to learning practices. Teachers are usually concerned with the outcome of teaching and learning practice. Therefore, they are most likely to assess the impact of implementing a new teaching method before adopting it. Badia *et al.* (2014:357) and Petko (2012:1355) both support this by noting that teachers measure the effectiveness of ICT in education based on its positive impact on the learning outcomes. They believe that technology in education should enhance classroom experiences for the improvement of learner performance.

2.4 The Influence of ICT on Classroom Experiences

A number of studies reviewed, indicated that teachers perceive the use of ICT for teaching purposes as a meaningful initiative in their practice (Adukaite *et al.,* 2017; Reigeluth *et al.,* 2011; Mama & Hennessy 2013; Göktaş *et al.,* 2009). Perrotta (2013:6) postulates that teachers believe that the use of ICT for instructional delivery provides access to a wide range of information that helps the teachers in planning their lessons. The ability of teachers to take full advantage of teaching and learning materials brought by technologies can contribute to their professional development. Moreover, the host of information availed on the Internet can serve as a useful resource that teachers can use to gain more insight into their subjects, and this could contribute to teacher and learner satisfaction. In a study conducted by Gibson *et al.* (2014:170) on the effect of technology on education, teachers indicated that technology-enhanced pedagogies afford learners a different learning approach that brings a new dimension to the classroom. The classroom environment changes into a more interactive space that builds learners' independent skills (Onofrei & Iancu, 2015:131). This promotes learners' creative skills which lead to great discoveries and gives birth to new knowledge. Brown *et al.* (2015) investigated how ICT can address the issue of discrepancies in teaching and learning resources between schools. The study found that technology introduces new learning approaches that bring a new learning dimension in the classroom, and further promotes active learning (Bozalek *et al.*, 2013:631). In addition, the ability of technology to enable information access to a wider spectrum to afford learners equal learning opportunities, thus limiting the difference among schools (Tire & Mlitwa, 2015:142). Moreover, ICT pedagogies create an environment where the learner can collaborate with their peers from across the globe to exchange ideas, thus promoting innovations. This would qualify the learners to be globally competitive, hence the promotion of ICT globally (Capriati & Divella, 2017:15).

Adu (2016:1737) explored the effects of ICT usage in South African secondary schools, in the Eastern Cape Province. The study found that ICT has many possibilities that can be

harnessed for the benefit of teachers and learners. The advantages of ICT which include time and space flexibility, do not restrict access to information (Kaur, 2013; Kearney *et al.,* 2015). The teachers and the learners can use this to their advantage by accessing study material at their convenience. This will promote the learning culture, in a sense that learners can continue with the learning process outside the classroom. This will ensure that the learning processes are not restricted to the school environments, but rather promote a learning culture among learners. Findings of the study conducted by Vandeyar (2013:253) revealed that teachers affirm that the use of ICT for instructional delivery enhances learning experiences by motivating learner participation in classroom activities. This promotes the active participation of learners in classroom activities and builds their life and career skills, which are relevant to the outside world. This means that learning institutions can then produce competitive graduates who are well skilled and prepared for the workplace. Perbawaningsih (2013:717) supports the fact that technology-enhanced pedagogies have a way of nurturing various skills in learners. Teachers interviewed in this study indicated that their support of ICT in education is informed by the curriculum implications of ICT, which should enrich learning outcomes (Goodwin *et al.*, 2015:134). These effects associated with ICT include its ability to bring real-world situations into the classroom, through its complex activities that challenge the mind. Such challenges involve critical thinking and a deep search for solutions, thus, the development of learners thinking capabilities, which is a useful life skill. Prestridge (2012:454) adds that the use of ICT in the classroom can build a learner's research skills. The sharing of ideas among learners from all over the world leads to the construction of new knowledge and establishes innovative skills among the learners.

Badia *et al.* (2014:358) studied the factors underpinned by teachers' attitudes and beliefs towards ICT for instructional delivery and reported that teachers value ICT use in the classroom. In this study, teachers displayed positive attitudes towards ICT, indicating that it improves their classroom experiences by promoting collaborations among learners, which in turn improves learners' abilities and further contributes to their performance. In

addition, (Sánchez *et al.*, 2012:1360) assessed teachers' attitudes and beliefs towards the use of ICT in their profession and discovered that teachers are embracing computer technologies. Teachers share views that ICT has been recently developed to fit the curriculum in order to improve academic performance; adding that teachers can manipulate it to maintain learners' interest while working towards improving the goal of meeting learning outcomes. Furthermore, teachers proclaimed that the flexibility of ICT provides easy access to information which improves learners' engagement in the classroom process, thus a high degree of interactions. Technology-enhanced pedagogies create an environment that allows learners to discuss subject matters with other peers and teachers. The study, however, revealed a significant difference between teachers' perceptions towards ICT and the actual implementation of ICT in their practice. This suggests that in addition to the benefits of ICT in education, it can also have adverse implications on the learners and that could explain the low usage of ICT by the teaches. According to Mwalongo (2011:43), the positive outcomes of ICT usage for instructional delivery are supported by the teacher's role to facilitate these proceedings. In other words, the teacher's guidance remains fundamental even in ICT pedagogies. Therefore, teachers should have the capacity to supervise ICT activities among learners in order to direct the focus of the use of ICT. Blackwell *et al.* (2013:313) upholds that ICT skills among teachers play a huge role in their ability to effectively use it in classroom practice. Teachers who are familiar with ICT are likely to use it in planning their lessons and even incorporating it in their professional practice. While on the other hand teachers who are not exposed to ICT are not likely to incorporate it due to the lack of skills. This concludes that there is a link between ICT skills and ICT usage (Gibson *et al.,* 2014; Petko, 2012; Van Den Beemt & Diepstraten, 2016; Sánchez *et al.*, 2012).

2.5 The Relationship Between ICT Skills and Technology Acceptance in the Classroom

A number of studies reviewed, concluded that teachers' perceptions towards ICT for instructional delivery are usually blurred by their own lack of ICT skills (Mumtaz, 2017; Osakwe *et al.*, 2017; Mwalongo, 2011; Padayachee, 2017). Mwalongo (2011:41) postulates that ICT competency among teachers affects the use of ICT in their professional practice. Furthermore, Kim *et al.* (2013:78) evaluated the relationship between teachers' beliefs towards ICT and their use of ICT for instructional delivery. The study found that ICT skills and knowledge are determinants of ICT usage in the classroom. Teachers who lack these skills are most likely to have negative perceptions about ICT and even choose not to implement it in their practice, whereas teachers who have ICT skills are likely to value it in their professional practice. Van Den Beemt & Diepstraten (2016:167) are also in accord with the link between ICT beliefs and the use of ICT in teaching practice. The study interviewed teachers about their perspectives regarding ICT pedagogies and reported that most teachers indicated that they are exposed to ICT in one way or another. Devices like smartphones and computers were reported to be commonly used among these teachers, but mostly for informal use, such as entertainment and socializing. The study concluded by noting that teachers stressed their need for ICT training for formal use in their profession. Therefore, access to ICT resources does not automatically mean effective use, but the correct skills and knowledge are what contributes to the effective use of ICT; thus, the importance of supporting ICT initiatives in school with ICT training for the effective use.

In Malaysia for instance, Umar & Jalil (2012:5676) assert that ICT pedagogies have been introduced to improve the quality of education. This initiative was further supported by ICT related courses that were aimed at ensuring ICT capabilities for effective usage. However, such developments are noted to be practical in urban places and exclude rural communities, thereby widening the digital divide. In other words, efforts have been made

to avail ICT resources and skills, but these resources are unequally distributed between urban and rural areas and this extends to the schools, resulting in the difference between urban and rural education.

Tire & Mlitwa (2015:151) sustain that ICT resources are unfairly distributed in schools. Rural schools remain underdeveloped while urban schools get first preference for most developments. Adding that in some instances rural schools are provided with computers, but these computers are usually underutilized due to the lack of ICT skills. The lack of ICT skills is a commonly reported challenge that limits the use of ICT (Chair *et al.,* 2017:3). As a result, the use of ICT in the classroom is likely to bring discomfort to the teachers who lack ICT skills, thus limiting the use. This can, however, be rectified by developing teachers with ICT skills, which will contribute to transformed learning processes and impact on learner attainment (Duma & Buthelezi, 2016:58).

2.5.1 Preparing Schools and Teachers for ICT Integration

In general, ICT resources have enhanced our lifestyles and there is even an increased dependence on it for the improvement of life in all spheres, including academic institutions. The introduction of ICT in schools has assisted in school administrative duties, school communication and teachers' professional development by proving improved ways that help in planning their lessons. Moreover, the use of ICT for classroom instruction has improved classroom experiences and positively contributed to teaching and learning outcomes (Mwalongo, 2011:45). In countries like Malaysia, Umar & Hassan (2015:2020) reported that the value of ICT in education has been realised, thus the provision of access to ICT resources in schools. Access to ICT resources in schools enables learners to access a variety of learning materials with ease, since learning materials also play a significant role in learner performance. The significance difference found by Tire & Mlitwa (2015:151) in learner attainment between privileged and underprivileged schools affirms the role of learning resources. Umar & Jalil (2012:5672) studied the use of ICT among secondary school learners and noted a difference in ICT competency between learners from

privileged schools, mostly urban; and underprivileged, rural schools. Therefore, the lack of ICT facilities, mostly in rural schools, is one of the major barriers that limit learners' potential and result in the difference in learner attainment between urban and rural learners.

On the African continent, the diffusion of ICT in the academic institutions has also been noted. As a result, ICT has been adopted in some African schools for the enhancement of classroom practices (Osakwe *et al.,* 2017:16). However, the effective use of ICT in other schools is challenged by barriers which include ICT access (Fuchs & Horak, 2008:104; Tire & Mlitwa, 2015:153). According to Redempta & Elizabeth (2012:144), the effective use of ICT means the accessibility of ICT resources, while on the other hand ICT accessibility in most African countries is a challenge due to the economic status of the countries. Mutua & Ng (2016:32) coincide that the inaccessibility of ICTs in Africa is because of high costs of the resources, while the continent has a very limited capacity to afford the provision of ICT resources. However, it is noted that in some countries, like South Africa, there is a huge technology gap; where some sectors are said to be exploring ICT at its maximum level, others are lacking the infrastructure that could grant them access to ICT. This indicates that the unfair distribution of ICT resources on the Africa continent is a problem that has contributed greatly to the escalating digital divide that threatens the growth of the continent, and this also has an impact on the educational institutions. Whereas, according to Umar & Hassan (2015:2016) education is the key fundamental to the development of the country and beyond. Therefore, the lack of ICT access in the country has a direct impact on education. As a result, schools are likely to suffer due to the lack of teaching and learning materials, which will then contribute to the quality of education. While on the other hand, the ability of the country to produce competitive graduates creates possibilities for the country. The availability of ICT resources in schools is central to the integration, therefore, the lack of such resources that can improve the quality of education in schools is a problem that should be tackled holistically.

In the South African context, the lack of ICT resources in most schools has been identified as a barrier that influences teachers' perceptions towards the use of technology for instructional delivery (Wastiau *et al.,* 2013:2099). Tire & Mlitwa (2015:141) coincides that most schools, predominantly rural, in South Africa are not well resourced with the necessary tools to support classroom practices. Some rural schools operate under poor conditions, and even traditional teaching and learning tools, such as textbooks are still a problem. In such instances, teachers' perceptions towards the use of ICT in education is usually blurred by such experiences they witness every day. As a result, it is likely that ICT is viewed as a luxury rather than a necessary classroom tool in these schools, and such perceptions have a negative effect on the integration. Ouma *et al.* (2013:500) assert that teachers are the driving forces of the use of ICT for classroom instruction. Therefore, their perceptions towards ICT in education are important. In the same study, Ouma *et al.* (2013) reported that teachers are now ICT minded; in a manner that they realize the potential of ICT and they are willing to integrate it in their teaching practices. Moreover, these teachers indicated that they find technology-enhanced pedagogies enjoyable to them and the learners, but this enjoyment is underpinned by the confidence in using ICT.

2.5.2 ICT Usefulness and Enjoyment in the classroom

According to Robson *et al.* (2015:411) the flexibility of ICTs creates enjoyable working environments that afford users fun working experiences. Users enjoy using their creative skills to explore a variety of ICT possibilities, which encourages innovation and the creation of new ideas that contribute to the body of knowledge. Subhash & Cudney (2018:204) add that games are widely known for their amusement. Therefore, the introduction of gamified learning systems improves learning environments by creating playful learning environments that capture learners' attention. The playfulness aspect of ICT is enjoyable to the learners and results in improved participations that promote competition and teamwork. Padilla-Meléndez *et al.* (2013:306) explored the effects of ICT enjoyment and gamification in education and reported that ICT playfulness strongly

influences perceived usefulness and ease of use, thus contributing to user attitudes and beliefs towards ICT. Baturay *et al.* (2017:8) also assessed the relationship between ICT competencies and intention to use. The study reported no significant relationship between ICT competency, attitudes towards technology-enhanced learning and intention to use. But rather, a correlation between perceived usefulness and enjoyment was found to have a positive relationship with attitudes.

In education, the entertainment aspect of ICT usage for educational purposes has the power to bring better understanding to learners through games and quizzes. The entertaining, yet educative aspect of ICT has shown a positive impact on classroom experiences by capturing learners' interest while elaborating on their critical thinking skills. Moreover, children are now exposed to technology at an infant stage, and children are the learners found in the classroom today. Because their lives are centred around technology, such learners find ICT fitting and necessary in all aspects of life, including education. As a result, there has been a growing concern on the need for change in sectors to accommodate the digital generation, since it has been widely noted that ICT serves as a motivation to them and contributes to the accomplishment of tasks (Wang *et al.,* 2013:416). Chao-Fernandez *et al.* (2017:576) evaluated the effects of gamification in education and reported that the introduction of ICT in education has brought about a significant difference in the classroom. Digital learning environment creates fun and lively learning environments that have resulted in improved learner attainment. New teaching and learning techniques that have emerged from technology-enhanced pedagogies, motives meaningful learning and arouses learner interest. This, however, requires appropriate ICT skills and competencies which seem to be a concern for most teachers. The deficiency of ICT skills among teachers is a crucial issue impeding the effective use of ICT in the classroom. Sipilä (2014) and Kopcha (2012) are also of the view that the usefulness of ICT in the classroom requires skills development for teachers.

2.6 Factors Hampering the Effective use of ICT for Teaching

The literature reviewed on teachers' perspectives about the use of technology for classroom instruction indicated a relationship between perceived usefulness and positive attitudes towards ICT. Thus, certain schools have integrated into digital learning. However, it was also noted that while some schools are manipulating ICT to its full potential; other schools, mostly rural, are faced with a number of challenges that affect the effective use of ICT for educational purposes. Halili & Sulaiman (2018:4) studied the use of ICT in rural schools in Malaysia. The study found that the use of ICT for academic purposes is useful and has the potential to bridge the digital gap between rural and urban schools. However, factors like the lack of technology facilities due to the high costs of ICT resources, skills deficiency and inaccessibility of ICT resources, are critical issues impeding the use of ICT in rural schools. In response to this, the Malaysian government has established National Broadband Initiatives (NBI) aimed at addressing the issue of inaccessibility of ICT resources in rural communities. The study further indicated that the challenges affecting ICT usage can be categorised as intermediary factors, which include gender, age and experience; and influential factors, which include facilitating conditions, social influence, performance expectancy and effort expectancy. With regards to influential factors, Teo *et al.* (2016:83) concur that teachers' expectation that using technology will enhance classroom experiences (performance expectancy) is a determining factor to the use of ICT in the classroom. Whereas with the intermediary factor, Du Toit (2015:17) sustains that gender differences also play a vital role in technology acceptance and usage.

Tondeur *et al.* (2018:36), however, investigated the impact of pre-service teachers' background (age and gender) on their use of ICT for classroom practice and found on the contrary. The study conducted a survey that consisted of 931 final-year pre-service teachers (student teachers) from 20 different universities in Belgium. The study reported no correlation between age and gender and the use of ICT for educational practice among teachers. Instead, the study reported a positive impact of attitudes and ease of use on ICT

competence. In addition, ICT skills among pre-service teachers wase reported low and this affected their use of ICT for educational practice. This suggests that focus should be directed on strategies that can help skill teachers with necessary ICT skills at university level, in order for them to use ICT effectively in their professional practice.

In Africa, Buabeng-Andoh (2015:308) assessed the use of ICT resources in secondary schools in Ghana, using a total of 650 secondary school teachers. Findings of the study showed that ICT usage in schools remains persistently low due to insufficient knowledge and training among teachers. The study further indicated that teachers in this study pointed out that textbooks are their only teaching and learning tool because of the lack of access to ICT. This, therefore, concludes that there is a significant correlation between ICT skills among teachers and the use of ICT for classroom instruction. Thus, necessary training is needed to develop teachers' ICT skills and knowledge, in order to contribute to the use of ICT in their professional practices. However, these critical barriers that hinder the use of ICT in schools in the enhancement of education remain unsolved. Addressing these issue calls for a better understanding of their cause. Thus, the following section breaks down these barriers into first-order barriers and second-order barriers.

2.7 Barriers to the use of ICT in Schools

According to (Prestridge, 2012:449), there are various factors that hinders the use of ICT usage in schools, these barriers can be categorised as first-order barriers and second-order barriers. First-order barriers to the use of ICT in schools are obstacles that do not form part of teachers' individual profile. These barriers are extrinsic and include unavailability of resources as well as lack of technical support. Koh & Chai (2016:249) sustain that first-order barriers that include school and teacher readiness, teacher perceptions towards ICT and interpersonal factors, can be major barriers to ICT integration in schools. Eke (2010:284) documented the African context of the use of ICT in the classroom. The study notes that the use of ICT in most schools on the continent remains low due to a number of challenges that hinders the growth of ICT around the continent. A number of studies sustain

that the biggest challenge affecting ICT growth on the African continent is unaffordability (Litheko, 2012; Gillwald, 2017; Nyambura *et al.*, 2017; Omotayo *et al.,* 2013). Constraints such as the lack of ICT resource, skills deficiency and poor infrastructure, are all centred around unaffordability due to high costs; this poses a great threat to the growth of the continent.

In the South African context, Sherman & Howard (2012:2101) examined the use of ICT for teaching among Cape Town secondary teachers in South Africa. A qualitative research method was used in this study, where two teachers from four different schools were interviewed. The study revealed that socio-economic factors also play a role in barriers to the use of ICT among certain schools. One of the schools in this study was a victim of socio-economic factors. This school was situated in a township affected by the high rate of crime and poverty, which had a direct impact on the school situated in this community. As a result, the school suffered from a lack of infrastructure due to theft. Teachers from such schools find themselves in a compromising position of working under challenging conditions. This concludes that computer provision and technical support are extrinsic barriers to the teacher, yet have a direct implication to them. Tire and Mlitwa (2015) evaluated the use of ICT in rural schools in South Africa and discovered that the uneven distribution of ICT resource and the lack of technical support for the teachers, are the key barriers affecting the effective use of ICT in most rural in schools in the country. Evidence of this was reported cases where some rural schools were operating under harsh conditions, like learning under the trees. The study also found that in some cases computers were availed in schools, however, there were other factors impeding the effective use. These factors are classified as second-order barriers.

According to Sherman & Howard (2012:2102), second-order barriers that affect the effective use of ICT to deliver instructional content are intrinsic factors that are sometimes rooted in cultural dynamics (Admiraal *et al.*, 2017:63). Makki *et al.* (2018:90) refer to these barriers as teacher-level barriers because they are factors that are directly related to the

teacher. Therefore, understating these barriers means studying teachers' attitudes and beliefs, as they are intrinsic factors which strongly affect ICT uptake among teachers for their professional use. A study conducted by Akinyemi (2016:30) on barriers to ICT uptake in Rwandan secondary schools, revealed that the lack of ICT skills among teachers is a strong factor that influences their attitudes and beliefs towards ICT use in education. Therefore, the successful implementation of ICT in teaching and learning processes is determined by the teachers' willingness to adopt ICT. A link found by Mama & Hennessy (2013:384), between teachers' perceptions and their use of ICT in the classroom, is evident. Brown (2017:62) also emphasises the importance of educating teachers with the necessary ICT skills can change their perceptions towards ICT uptake for classroom experiences.

Bray & Tangney (2017:268) also argue that technology-enhanced pedagogies are full of possibilities that can bring positive change in teaching and learning experiences, if well managed. Managing the use of ICT for educational purposes means skilling teachers with necessary ICT skills that will enable them to better facilitate technology-enhanced pedagogies. Adams *et al.* (2017:83) are of the view that the successful implementation of any changes introduced in the classroom is dependent on teachers. This suggests that changes in teachers' professional practice should be supported by professional development. Kennedy *et al.* (2016:157) conducted a study on the effect of professional development in practice change. The study highlighted the importance of preparing teachers for the change. Teachers who participated in professional development initiatives displayed a high level of implementing knowledge acquired into practice. De Araujo *et al.* (2017) explored the challenges and benefits of flipped instruction in a classroom and reported that teachers showed positive attitudes towards the use of ICT for teaching purposes. These positive attitudes were also reported to motivate teachers to implement ICT in their professional practice (Prestridge, 2012; Copriady, 2015; Adukaite *et al.*, 2017; Tondeur, Roblin, *et al.*, 2017).

Other studies, however, found that negative attitudes towards ICT can have inverse implications. Hwang & Cha (2018:282) postulate that the lack of ICT skills among teachers is a strong predictor of ICT usage in the classroom. This suggests that teachers who are familiar with technology are likely to employ it in their teaching practice, unlike those who are not familiar with ICT. As a result, teachers who are unfamiliar with ICT feel intimidated by it, resulting in technostress, which influences the intention to use technology.

2.7.1 Technostress

According to Hwang & Cha (2018:289), technostress refers to the anxiety and unease due to the use of innovative technologies. This stress that comes with the use of technology has adverse implications on the job performance. Fuglseth & Sørebø (2014:168) explored the effect of technostress on employees' use of ICT in a working environment and echoed that employers need to respond to technostress by providing necessary technical support to employees. In teaching, the lack of necessary ICT skills to integrate ICT into the curriculum put pressure on teachers, which results in stress that is related to the use of technology. As a result, the use of ICT for teaching and learning purposes places undesirable worry and tension on the teachers because of the pressure of the "digital natives" notion, which causes pressure and can result in technology rejection (Jena, 2015:1122). Joo *et al.* (2016:118) also examined the effect of technostress on teachers' intention to use technology, using a sample size of 312 secondary school teachers in South Korea. The study found a relation between technical support and technology anxiety among teachers, which has a direct impact on teachers' intention to use technology. This suggests that obstacles like the lack of infrastructure, inadequate skills and lack of support are most likely to negatively affect the use of ICT for classroom instruction. Whereas global changes, such as the Fourth Industrial Revolution no longer place ICT capabilities as a need but now a demand.

2.8 Understanding the Digital Revolution

According to Schwab (2016:1) and Alves *et al.* (2016:2) the Fourth Industrial Revolution (4IR) refers to the major industrial era that infuses technology into the physical space. These advanced technological developments include Artificial Intelligence (AI), machine learning, biotechnology, nanotechnology and automation (Mail & Guardian, 2017). Eberhard *et al.* (2017:49) adds that Industry 4.0 is a digital revolution that was envisioned by the German government as a step in securing its production competitiveness. The revolution means a change in the labour market; transforming the traditional physical space into the digital sphere. Industry 4.0 is, therefore, a digital era that brings technology to humans in all sectors of life. Alves *et al.* (2016:12) further explain the role of the human in Industry 4.0, that the digital revolution will relieve humans of most of the work, and then they will assume the role of the facilitators. This, however, poses a threat to job security and leads to the rejection of the revolution. Nevertheless, the invasion of the revolution is definite; whether embraced or rejected, and there is a consensus that changes brought by the revolution will shake the industry (Summers, 2014; McCarthy, 2014). Thus, affecting the link between employment and education attainment in the automation era (Peters, 2017:4).

However, Alves *et al.* (2016:12) reported on the contrary; they note that the labour force will still require and value human intelligence. New ICT skills will emerge, that will require the right knowledge and necessary skills to support it (Schwab, 2016:4). Eberhard *et al.* (2017:57) are of the view that the revolution will create new opportunities that will give rise to new skills and knowledge procurement. Thus, transforming educational institutions in terms of skilling learners with necessary skills demanded by this advancement in order for the learner to be relevant in the outside world (Cirillo *et al.,* 2018:14). Therefore, the introduction of Industry 4.0 comes with a horde of opportunities that awaits people to harness, but with the right skills and knowledge.

2.8.1 The Impact of the Industrial Revolution on Education

According to Alves *et al.* (2018:13) education is at the heart of Industry 4.0. The sustainability of the revolution heavily relies on new professional skills that can only be attained through education. While others see the Fourth Industrial Revolution as a threat (Eberhard *et al.*, 2017; Mail & Guardian, 2017; Peters, 2017), Schwab (2016:4) upholds that the revolution will be "empowering and human-centred". Moreover, Schwab further highlights that humans have and always will have control over technology and the power to reshape it for the common will of improving the world. But the range of opportunities presented by these emerging trends would only be fruitful to the industry if they are better understood. Thus, the role of educational institutions to encourage and promote innovation and creativity. That is, educational institutions need to prepare themselves to adapt to the transformation brought by the digital revolution, in order to be in a position to skill the learners with the necessary skills demanded by the revolution (Eberhard *et al.*, 2017:48). In other words, the way educational institutions impart knowledge to the learners will have to be upgraded in order to align to the demands of the automation era. In this sense, new forms of collective intelligence will emerge to strengthen the industrialization (Peters, 2017:4). Therefore, education institutions must train people with relevance and prepare them with needed skills that have been created by the Fourth Industrial Revolution.

2.8.2 The Relationship Between the Labour Market and Education Training

Technology and its advanced developments have continued to reshape the labour market. Recent innovations have given a new dimension to job dynamics and further created new opportunities in the industry, hence, the need for new and improved skills in the labour market (Cirillo *et al.*, 2018:2). Schwab (2016) concurs that technology has modified business trends, in a manner that has contributed to the growth of the labour industry. New skills have emerged out of advancements in technologies, resulting in the increase of

human employment which further contributes to the economy. Advanced technologies have promoted innovations, which has given birth to new business and resulted in the increase of human employment.

However, some industrial sectors are finding it difficult to trust and invest in the industrial revolution (Brynjolfsson & Mcafee, 2012). As a result, some industries are still fixated on the traditional measures of ICT because of the fear of the unknown future of robotics. Frey & Osborne (2013:36) assessed the relationship between automation, human labour and educational attainment. They maintain that in the past, revolutions technology and education have sustained a productive relationship. But the introduction of the new revolution, Industry 4.0, comes with complexities that taint the relationship between the two, leaving the future of employment in the automation nation indefinite. The study concluded that it is not easy to predict the outcome of the digital revolution. Nevertheless, it was projected that the advancements in technological developments are likely to soon take over in the non-routine manual task. Meaning that human labour in such aspects may have no room in the digital industrialization. Therefore, there are strong indications that the revolution is most likely to introduce computers for labour substitution to some extent. Evidence of this is the reported high rate of jobs at risk due to automation (Brynjolfsson & Mcafee, 2012; Frey & Osborne, 2013; Piva & Vivarelli, 2018). The introduction of automation in the labour market will simply mean that the task that was performed by humans will be performed by the robot, at possibly a different pace. The employers might, therefore, not have the capacity to retain both the robot and the human, which could then drive the industry to the downsizing of employees. Brynjolfsson & Mcafee (2012) explored the effects of the fast-growing advancements of technologies on employment change. The study highlighted that in the past industries have responded to the recession by introducing robots in substitution of human labour. However, some human skills remained in demand, while some had lost its value to the technologies. Hence, the relationship between technologies and occupations remains complex due to the progression pace of technology. In other words, the impact of revolution on employment is multifaceted and this has

brought confusion and different views about the changes brought by the digital revolution in industries (Autor & Dorn, 2013:1555). While some authors believe that the slow diffusion of technologies in the labour market results in the decline of jobs, some believe that the unprecedented speed of technology growth, that people cannot keep up with, is the cause of job decline (Brynjolfsson & Mcafee, 2012; Mail & Guardian, 2017).

However, Pirvu & Zamfirescu (2017:5) contend that advanced technologies have brought a negative impact on employment. They maintain that the changes brought by the revolution, Industry 4.0, are meant to encourage the co-existence of humans and technology in all spheres of life, including labour industries. The industrial revolution is, therefore, said to introduce new opportunities that will benefit the industry, the people and the economy at large. However, necessary skills are fundamental in this transition in order to grasp and relish these opportunities. Eberhard *et al.* (2017:57) are of the view that the opportunities provided by the digital revolution will require human interaction, which will then create the need for creative and innovative skills. The possibility of these skills would be brought to life by the academic institutions, thus making education systems the driver of the revolution (Peters, 2017; Pirvu & Zamfirescu, 2017). Academic institutions, therefore, have a central role to play in nurturing creativity and innovations in order to ensure the success of the revolution and the future of employment.

Oesch (2013:2) evaluated the impact of technology and education on employment change. The study revealed that education, technology innovation and labour market institutions are the driving forces of occupational change. Cirillo *et al.* (2018:14) concur that the level of education is a strong factor that affects employment change and further contributes to job growth. Therefore, there is a strong bond between employment and education. Thus, adjustments in education systems have been aligned to the demands of the labour market in order to ensure relevant skills attainment. Pirvu & Zamfirescu (2017:1) add that there is a strong, inseparable connection between jobs and skills, and these labour skills are measured by the level of education (Bol, 2015:107). Educational institutions play a role in

producing for the labour industry by providing relevant skills that enable one to be qualified, thus securing employment in the labour market. The increased demand for skills in the labour market have, therefore, enforced schooling culture across the globe. Although the education system differs across countries, workplace competencies, however, remain rooted in education (Freeman & Schettkat, 2001:601); thus, the importance of education globally, including rural schools (Tamayo *et al.*, 2017:113). The usage of innovative technologies in schools should, therefore, be enforced at par even in rural domains in order to build a labour competitive nation.

2.9 Conclusion

This section has highlighted the importance of technology in all spheres of life. Special attention has been given to the usage of ICT in the workplace and academic institutions. The reviewed literature has indicated that ICT continues to gain momentum, with increased dependence on technologies in human lives. It has also been noted that government, globally, has realised the importance of ICT in human life and has taken measures in improving the quality of education by ensuring the use of innovative technologies for academic purposes. Furthermore, the literature reviewed has highlighted the changes brought about by the advancement in technology, the Fourth Industrial Revolution. The implications of this revolution have been discussed to an extent that it can be concluded that ICT capabilities have become a demand, and the right start to ICT skills attainment is educational institutions. Therefore, even more efforts should be made to ensure that learners are equally equipped with the necessary skills for the demanding labour market. That is, as we are at the brink of the Fifth Industrial Revolution, while the 4IR boat has already been missed by many, blended learning should be enforced in the rural schools in order for the learners to equally grasp knowledge management capabilities. The next chapter focuses on the conceptual framework of this study, explaining how the communication models can help solve the problem in question.

CONCEPTUAL FRAMEWORK

3. Introduction

According to Caffery (2018) a conceptual framework refers to the broader ideas that outline the structure, rules and focus of the study. Magher (2018) postulates that a conceptual framework uses existing theories to frame or guide the study. The models employed in this study are linked to the concept of communication. According to De Wet (2010:2), communication is making common; which suggests that there should be a mutual understanding between a communicator and a recipient in the process of sending and receiving a message. For Dainton & Zelley (2015:4), communication is the flow of information from one person to the other. Communication, therefore, plays a major role in understanding how a conveyed message has been interpreted by the recipient. The conceptual framework of this study draws from the Technology Acceptance Model and the Interactive Model. The two models interrogated in this study are used to understand the communication perspective of the influence of innovative communication protocols in a rural classroom. The study suggests that the Technology Acceptance Model and Interactive Model are the most suitable models to explore the impact of technology use for educational purposes in rural secondary schools within the KCDM.

3.1 Technology Acceptance Model

According to Venkatesh (2000:343), Technology Acceptance Model (TAM) is a model coined by Fred Davis, in his doctoral thesis, to explain user behaviour towards the adoption of computer technologies. The model was adapted from Fishbein & Ajezen's 1975 Theory for Reasoned Action (TRA) *[Figure 1]*, which suggests that behaviour is informed by attitude; while TAM is concerned with the factors influencing users to use computer

technologies (Venkatesh & Davis, 2000:187). In their Theory of Reasoned Action, Fishbein & Ajzen found a correlation between user intention and behaviour toward computer technologies (Montaño & Kasprzyk, 2015:68). Al-Adwan *et al.* (2013:6) found behavioural intention as a common function of TRA and TAM.
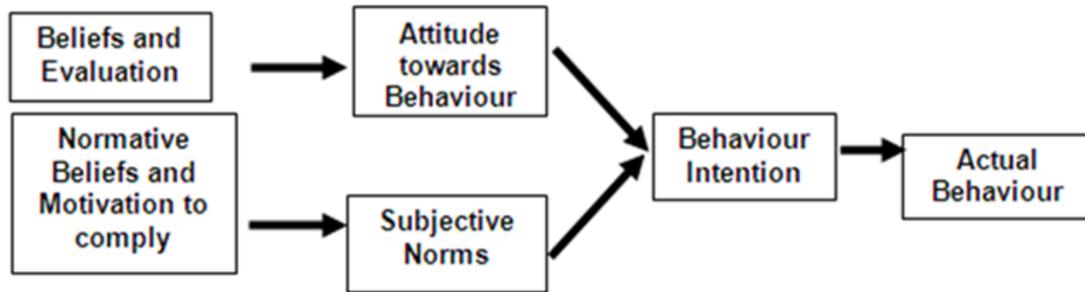
Figure 1: Theory for Reasoned Action
(Adapted from Al-Adwan *et al.*, 2013)

TAM is a popular model associated with the Acceptance of Technology. The model suggests two beliefs, Perceived Usefulness (PU), and Perceived Ease of Use (PEOU), that influence user behaviour towards the use of technology (Yen *et al.*, 2010:906). Venkatesh & Bala (2008: 275) explored the use of TAM to understand the use of ICT in the workplace and found that subjective norms and PEOU are factors that influence PU. Venkatesh *et al.* (2003:448) also studied the determinants of technology acceptance in the workplace and found a significant relationship between performance expectancy and intention to use. That is, the users are more concerned with the performance outcome of using a system. Hence, an individual chooses to use a system if they believe that it will help increase their job performance. TAM has been applied in various disciplines where it has shown that behavioural intention is a dependent variable that has a significant relationship with PU and PEOU (Faqih, 2013; Renny *et al.,* 2013; Yoon & Barker Steege, 2013; Mohammadi, 2015).
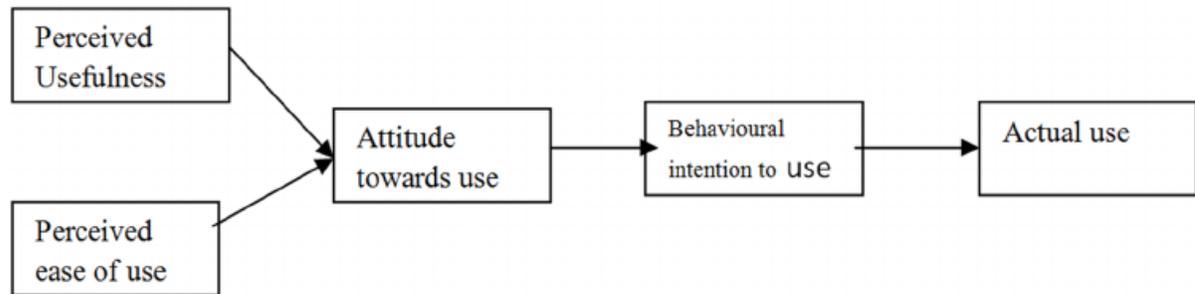
Figure 2: Original Technology Acceptance Model
(Adapted from Alwahaishi & Snášel, 2013)

In the teaching context, Scherer *et al.* (2018:31) adopted TAM to explain the factors that influence the extent to which teachers use technology in the classroom, and revealed that the extent to which teachers use technology in the classroom is influenced by external factors. Therefore, enhancing teachers with necessary ICT skills can influence their PU and PEOU beliefs on technology, resulting in increased use of ICT in the classroom (Mei *et al.,* 2018:74). Fathema *et al.* (2015:221) also used TAM to investigate factors that affect teachers' attitudes and beliefs towards the use of Learning Management Systems (LMS) in higher education, from two universities in the United States. The findings of the study revealed that external variables which include system quality, perceived self-efficacy, and facilitating conditions have a significant influence on the use of LMS by teachers. This suggests that developing teachers with necessary ICT skills can help increase the use of technology for teaching and learning purposes. In an analogous study, Schoonenboom (2014:252) also explored factors that affect teachers' use of LMS in higher education in the Netherlands. The study reported that PU and PEOU are strong predictors of the increased usage of LMS among teachers. In other words, the high level of the system's usefulness and user-friendliness are variables that strongly affect technology acceptance by users. Jeong & Kim (2017:508) are also in consensus that self-efficacy is a salient factor of technology acceptance. That is, ICT capability has a direct impact on technology acceptance and further influences user's perceived usefulness. Alharbi & Drew (2014:151) also measured teacher's behavioural intention to use LMS in Saudi Arabian public

universities using TAM. Findings of their study confirm that there is a significant relationship between perceived usefulness and behavioural intention. Teachers with positive attitudes towards technology are most likely to find it useful in their practice.

In the learning perspective, literature reviewed indicates that the acceptance of technology by the students is determined by factors associated with behavioural intentions (Persico *et al.,* 2014; Calisir *et al.*, 2015), which contributes to the effective use of technology (Jan & Contreras, 2011; Joo *et al.,* 2011; Joo & Sang, 2013). Tarhini *et al.* (2017:316) examined the effect of individual-level cultural values on the acceptance of technology among university students in Lebanon. The study revealed that behavioural intention is influenced by a number of factors which include social norms, PU and PEOU. The findings of the study conducted by Cheung and Vogel (2013:169) confirms that behavioural intentions to use technology is strongly influenced by PU. In their study, Cheung & Vogel (2013) investigated student's attitudes towards the use of technology in Hong Kong Polytechnic University. A total number of 136 students participated in the study. The study found that students' intention to use technology for learning purposes is influenced by collaborative learning environment offered by technology pedagogies. The level of information sharing motivates the use of technology among students, thus PU which predict behavioural intention towards technologies.

Cacciamani *et al.* (2018:126) assessed technology acceptance among students in Italian high schools and note that PU, PEOU, support conditions and empowerment in learning are factors affecting learners' acceptance of technology for learning purposes. In the same study, learners indicated that they find technology supportive in their learning activities, thus their acceptance of ICT for learning. This, therefore, supports that PU is a predominant factor of technology acceptance. Pinhati & Siqueira (2014:768) coincide that learners perceive technology as a useful learning tool. As a result, technology has been reported to gain momentum in learning spaces (Teo, 2010; Park *et al.*, 2013; Teo & Noyes, 2014; Al-gahtani, 2016; Rienties *et al.*, 2016). The ability of technology to support learning activities

is a strong determinant of the acceptance of technology in the classroom. Furthermore, collaborate learning environments provided by technology enables students to share information, which strongly motivates students' attitudes and beliefs towards technology use.
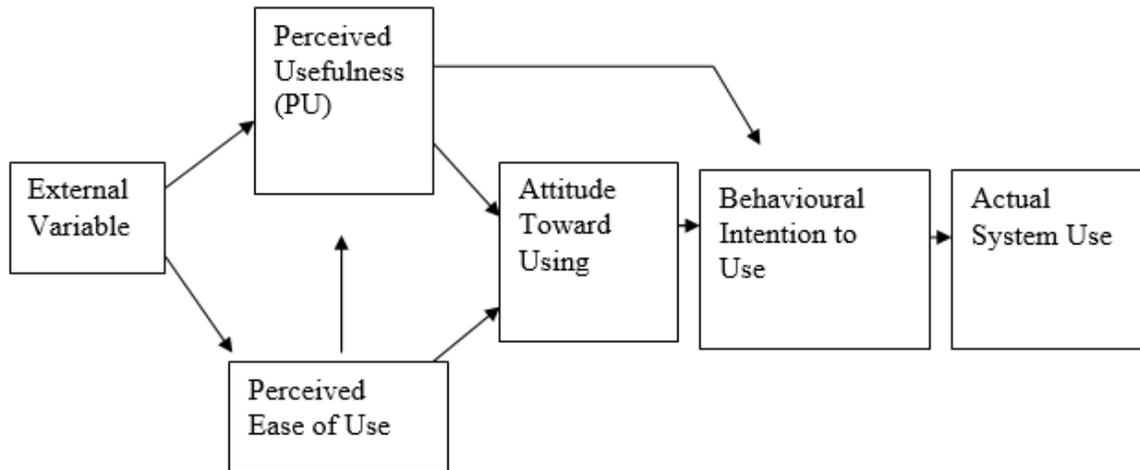
Figure 3: Technology Acceptance Model
(Adapted from Devis, 1989)

3.1.1 Perceived Usefulness

According to Davis (1986:26), perceived usefulness is an extent to which an individual believes that using a particular system will enhance their job performance. This definition draws from the "advantage" generally meaning useful, which in this context suggests that an individual evaluates the advantages associated with using a particular system before choosing to use it (Davis, 1989:320). That is, the influence of the system on the job performance is central to the acceptance of a system. In the context of teaching and learning, Baydas & Goktas (2016:172) explored the influential factors associated with teachers intention to use technology for their lessons in Turkey. The study found that teachers who perceived technology as a positive teaching tool displayed high intentions of technology use in the practice. Korobili *et al.* (2010:401) coincide that the high use of

technology in education is associated with potential positive beliefs of technology. The ability of ICT to support teaching and learning activities has been identified as a strong determinant of technology usage in educational institutions (Attuquayefio & Addo, 2014; Mutua & Ng, 2016; Teo *et al.,* 2016; Miguel & Okazaki, 2017).

3.1.2 Perceived Ease of Use

Amin *et al.* (2014:262) explain perceived ease of use as the degree to which an individual believes that using a system will require less of their effort. PEOU is a significant variable that influences user acceptance of technology (Lin & Kim, 2016:714). According to Davis (1989:320) perceived ease of use has a direct influence of perceived usefulness, behavioural attitude, intention to use and actual use. Findings of the study conducted by Al-rahmi & Zeki (2017:7) also support that PEOU and PU contribute to the user's satisfaction with technology. In the same study, Al-rahmi & Zeki (2017) investigated the impact of social media on learners' performance. The study found that various advantages associated with the use of technology such as usefulness, ease of use and enjoyment, contribute to learner satisfaction, hence the results. The learners, which Akçayir *et al.* (2016:435) referred to as "digital natives", find enjoyment in technologies and as a result, their lives are shaped by technology. It is, therefore, for this reason, that this kind of generation finds technology useful and easy to use in all aspects of living, including education. The flexibility of technology enables learners to share learning material and also contributes to learner performance (Gallego *et al.,* 2016:87). Goodwin *et al.* (2015:135) are of the view that technology has popularity due to its usefulness and advantages that come with using it, resulting in positive attitudes towards technology use.

However, the usefulness and ease of technology use are strongly dependent on one's technical abilities. A number of studies concluded that technology skills and abilities among teachers remains a big challenge and a barrier to the acceptance of technology in education (Sipilä, 2014; Hrtoňová *et al.*, 2015; Kubrický & Částková, 2015; Bray & Tangney, 2017; Palomino, 2017; Tarhini *et al.*, 2017). Triyono (2015:60) notes that

supporting teachers with technical skills can help improve the use of technology in education. That is, teachers whom Czerniewicz & Brown (2013:4) describe as a digital stranger because of their limited exposure to ICT, find it challenging to accept the use of technology in their practice (O'Bannon & Thomas, 2014:21). As a result, such teachers are unlikely to see the usefulness of technology in their practice because they perceive technology use as a daunting and challenging task, and this leads to negative attitudes towards technology. Supporting teacher growth in technology-enhanced learning can, therefore, contribute to the acceptance of technology use in the classroom (Adams *et al.*, 2017; Ní Ríordáin, Paolucci & O' Dwyer, 2017), hence positive learning outcomes.

3.2 Interactive Model

According to Hendricks (2018), the interactive model of communication, also known as the convergence model is a two-way communication process that ensures active participation of participants involved in the exchange of messages or information. The model suggests three roles; that includes the sender, the receiver and the participant (Marín *et al.,* 2016:4948), which are interchangeable in the process of exchanging communication (Zhang & Lin, 2015:674). That is, the model is mainly concerned with the interaction between the sender and the receiver, and the receiver and the sender. The model upholds that meaning comes from both sources involved in the communication process, thus the importance of feedback. This indicates that communication is a two-way process, therefore, there should be collaborative participation from both parties involved in order to provide meaningful messages. This suggests that meaning comes from both sources involved in the communication process.
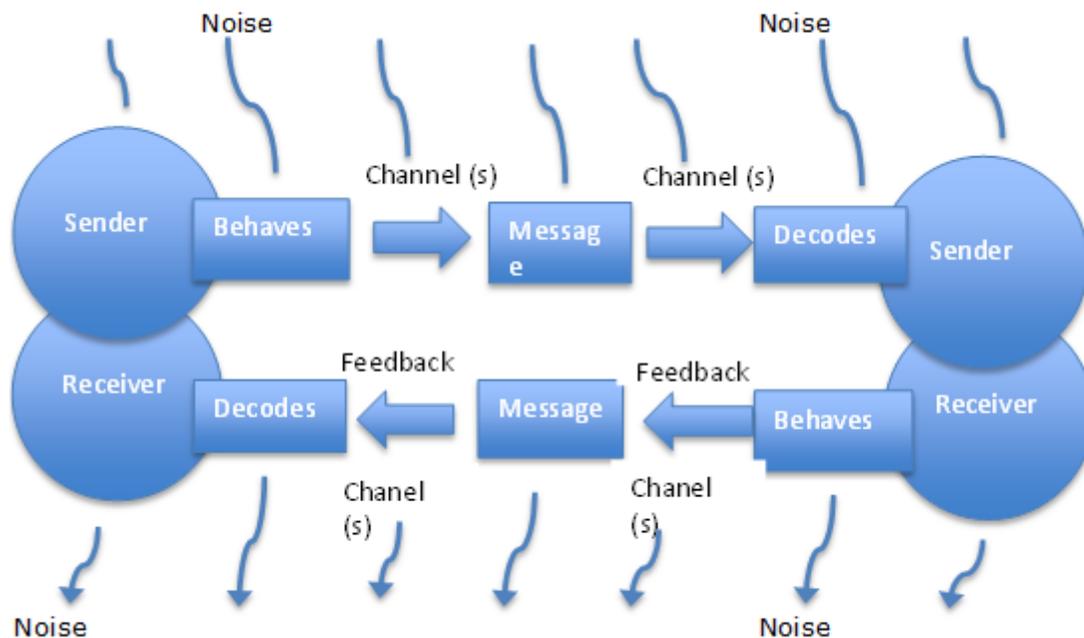
Figure 4: The Interactive Model of Communication
(Adapted from Research Gate, 2018)

With reference to this study, interactive communication refers to the teacher and learner participation in classroom activities. This suggests that the teacher, who predominantly plays the role of the sender, sends messages to the learners who play the role of the recipient − and both sources are required to be active participants in this communication process. The participation role in this process will then lead to feedback, which out of it the sender is able to understand how the conveyed message was interpreted by the recipient. According to Lin (2017:21), the interactive approach plays an important role in learning. The approach suggests that teachers no longer assume the dominant role in the classroom, but rather both the teacher and the learners participate in the exchange of information and ideas in the classroom. As a result, learners interact with their peers as well as their teachers in problem solutions of the subject, thus the interactive teaching and learning approach (Lim, 2017:409). Wassermann (2017:5) found that the interaction between the teacher and

the learners leads to productive classroom discussion that builds the learners' thinking capacity. Furthermore, Cerezo *et al.* (2016:48) explored the impact of interactivity in learning and found that interactive learning introduces a new dimension in the classroom that has a potential to improve learner performance.

However, the classroom interaction is most effective when supported with the necessary resources (Beauchamp & Kennewell, 2010:763). Kuo *et al.* (2014:42) studied interactivity in the technology-enhanced classroom and note that the use of ICT in the classroom brings a new dimension that promotes interaction in the classroom. The use of ICT in the classroom creates an environment that involves learners in classroom activities (Wu *et al.,* 2010:159). In other words, the interactive teaching approach ensures that learners are not passive participants in knowledge sharing in the classroom, but they are also active participants of classroom proceedings. Thus, the interchangeable communication roles (sender, receiver).

3.2.1 The Sender

In the communication process, the sender refers to the originator or the initiator of the message who sends a message to the receiver (McQuail & Windahl, 2013:14), in order to fulfil a certain need (Steinberg, 2007:31). Zhang & Lin (2015:682) adds that the main goal for the communicator to interact with the recipient is to express thoughts or feelings effectively. Thus, the sender purposefully forms the message intended for the recipient and encodes it through verbal or non-verbal signs (Castañer *et al.,* 2015:2), which gives the sender control of the message (Marín *et al.,* 2016:4948). That is because the sender is in the position of initiating communication; the sender can then decide what to say, and to whom.

Pertaining to this study, teachers communicate with the learners to exchange information in order to meet learning outcomes. In the context of teaching and learning, the teacher is usually the one who initiates the communication in the classroom; therefore, in this study,

they assume the role of a sender. The study suggests that the teacher, as the sender of learning activities, purposefully plans the lesson to deliver to the learners. The use of the Interaction Model in this study, therefore, suggests that the teacher should plan the lesson in a manner that engages the learners to actively participate in the learning process. This could be achieved through posing questions to the learners that probes discussions and debates. Such discussions have a potential to challenge the learner, individually, while building their thinking capacity. This is in accord with the findings of the study conducted by Pachler *et al.* (2010:719) which indicate that classroom discussions are rich or productive. Moreover, the teacher would still maintain control of classroom instruction, which is meaningful since teachers are also guided by the curriculum. Therefore, the purpose of learning will still remain as technology-enhanced pedagogies will not deprive teachers of their position as instructors who purposefully direct classroom instruction. Furthermore, this kind of interaction, face-to-face, could yield positive results as it brings both participants together in the same space. As a result, participants have an opportunity to use verbal and non-verbal signs to send messages, which Smith (2013:82) affirms that learners relate to the use of gestures for instruction delivery.

Dainton & Zelley (2015:216), however, note that there is a relationship that exists between the communicator's competencies and the receiver's satisfaction (Solomon & Theiss, 2013:37). This suggests that the effectiveness of the message sent can also be affected by the sender's ability to communicate effectively. The feeling in this study is that if teachers master the technique of good communication with the learners, learners would interpret the messages as intended by the sender, thus understanding of the information communicated by the teacher and resulting in improved learner performance.

3.2.2 The Receiver

According to Steinberg (2007:44), the receiver is the one who listens or accepts the message (Seiler & Beall, 2011:22). The recipient's role in the communication process is not merely to receive the message, but the receiver has an important role to play in interpreting and making meaning of the content of the message communicated (Murphy & Sashi, 2017:2). Therefore, the recipient has to actively participate in the communication process in order to understand and interpret the message and be able to produce meaningful feedback (Steinberg, 2006:14). In other words, the recipient also has an equally important role to play as the sender in ensuring the effectiveness of the communication process (Ngai *et al.,* 2015:40). This suggests that unlike in linear communication where the recipient plays a passive role (Sellnow & Seeger, 2013:10), the interactive communication is concerned with equal participation of both sources involved in the communication process.

In this study, learners assume the role of recipients of the messages encoded by the teachers. As recipients of the messages, the learners are expected to pay careful attention to the instructions given in order to make meaning out of it and produce feedback. In other words, the active participation of learners is as important as the teacher's role in the classroom. Therefore, this suggests that learners must be given a platform that will enable them to take part in classroom activities. This could be in a form of classroom discussions and also asking questions, thus giving the teacher an understanding of how learners interpreted the given instruction. The study argues that traditional learning measure limits learner participation in the classroom and suggests that the use of ICT can help promote teacher-learner interaction. In accordance with this is Musakophas & Polnigongit (2017:71), who studied participatory communication in Thailand and reported that traditional medium of communication makes people passive participants, while innovative communication protocols ensure active participation of both sources involved in the communication process. Thus, this study proposes the use of ICT for instruction in a rural

classroom in order to ensure that learners do not take a backseat in the teaching and learning process, but they should be actively involved.

3.2.3 Encoding and Decoding

Dainton & Zelley (2015:208) postulate that encoding is a process whereby the communicator transforms thoughts and ideas into verbal and non-verbal signs in order to transmit it as messages to the receiver. The recipient of the message then interprets the message in order to understand what is being communicated; this process is then referred to as decoding. In this case, the receiver of the message, i.e. the learners as the receivers of the messages encoded by the teachers, using their thinking skills to interpret the messages and make meaning of the messages in order to produce a meaningful response.

3.2.4 Feedback

For McQuail & Windahl (2013:5), feedback has to do with the information that the receiver sends back to the sender in response to the communicated message. Steinberg (2007:50) adds that feedback includes verbal and nonverbal responses (Solomon & Theiss, 2013:156). That is, the recipient may need to indicate to the sender that the message is understood or the recipient may also indicate confusion through the use of facial expressions. Feedback is what differentiates interactive communication from linear communication. Feedback gives the recipient an opportunity to also send a message (Ernst & Steinhauser, 2017:37).

In the teaching and learning perspective, Zhang & Hyland (2018:94) investigated the effect of feedback on student engagement and found that feedback impacted on student development. This is to say that student engagement is the core of student enrichment, suggesting that the students learn better when they are involved in the learning activities. Tivener & Hetzler (2015:216) examined the role of student response and interactivity in learning and found a significant contribution of interactivity on knowledge acquisition. That is, students grasp and understand better when they are given a platform to contribute

to the learning process. Furthermore, Alwagait *et al.* (2015:1095) examined the impact of social media on learner performance. The findings of the study revealed that social media has the potential to be used effectively as a learning tool. Learners can easily interact with each other to exchange information and this can positively contribute to their academic performance.

Given the effect of students' response in their academic performance, this study proposes the provision of learner response in order for the teachers to understand how learners interpret learning instructions. As observed by Tire & Mlitwa (2015:151) and Litheko (2012:16), there is a great need for rural classrooms to evolve to better learner engagement in order to contribute to learner performance. This study suggests that there is a need for the rural classroom to improve engagement of learners through question and answer sessions. The argument is that learners should now be part of the knowledge production, in the essence of robust discussions and in-depth investigation that will bring a new dimension of learning in a rural classroom setting. Masantiah *et al.* (2018:3) also affirm that student feedback can be useful in measuring student ability level.

3.3 Message

According to Steinberg (2007:46) and Seiler & Beall (2011:21), the message refers to the ideas, feelings or thoughts expressed by the sender to the receiver, which can either be expressed verbally or non-verbally (Dainton & Zelley, 2015:208). The expressions, however, vary. While some messages are formulated with straightforward and clear meaning, other messages may be ambiguous and not easy to understand. Yet, these expressions have meaning attached to it, which need to be understood by the receiver. Thus, sending and receiving of messages requires some degree of mental effort from both participants (Muk & Chung, 2015:2). Steinberg (2006:14) adds that the message carries different types of information which attach meaning, and this includes content information and relational information.

In relation to this study, messages refer to the instruction given by the teacher to the learner. Also, the learner response forms part of the messages in this context. Therefore, the exchange of information and ideas in the classroom from both participants (the teacher and the learners) is shaping the learning processes. Meaning that at times teachers would give ambiguous instructions which are meant to challenge and build learners thinking capacity, and learners are also expected to interpret and convey the message back to the teacher, thus the interactive learning process. The study, therefore, suggests that the sending and receiving of messages in the classroom accommodates the learners as well; in a sense that the teachers should also be willing to be recipients of the ideas conveyed by the learners. This has the potential to change the communication which has been observed as linear into a two-way communication process in which there is high interaction of learners in the learning process. This study used the two Models discussed to present a proposed framework for ICT integration in rural secondary schools.

3.4 Proposed Framework

The proposed framework for this study is formulated in relation to the two models Technological Acceptance Model and Interactive Model. The following diagram presents a proposed framework for ICT integration in rural secondary schools. The diagram consists of the current, desired and the future state of ICT usage in rural secondary schools.
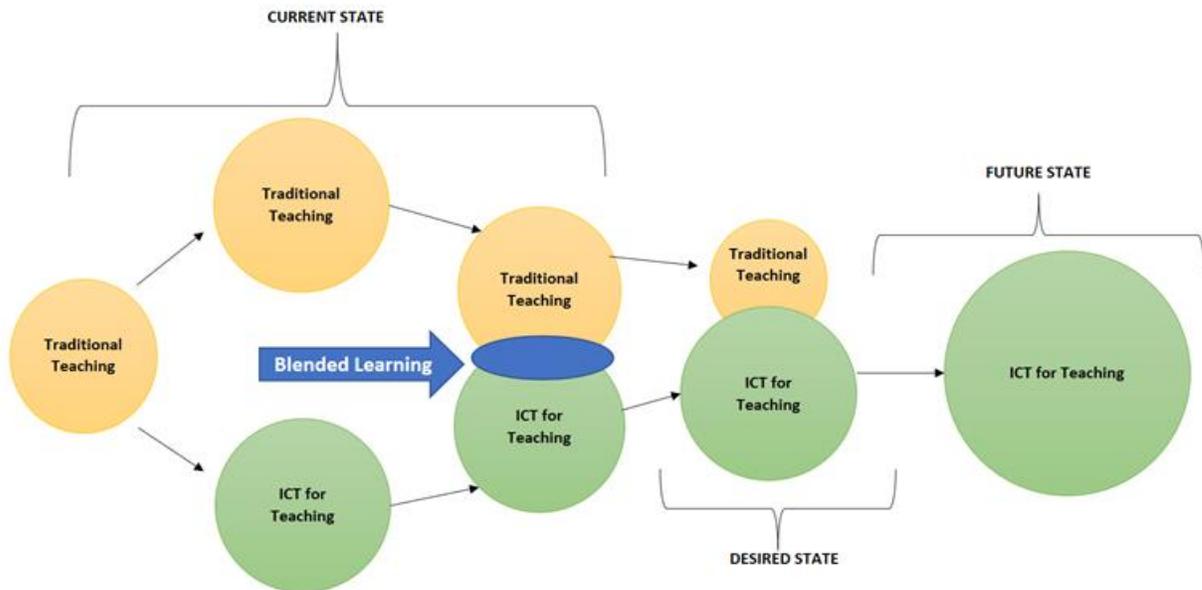
Figure 5: Proposed Framework for ICT Integration in Rural Secondary Schools

3.4.1 The Current State

With reference to Figure 5, the current teaching state in most rural secondary schools is, predominantly, the traditional teaching approach. According to Genlott & Grönlund (2016:73), traditional teaching approach refers to the delivery of classroom instruction without the assistance of modern technologies, such as ICT. Traditional pedagogies are famous for limited teaching-aids with only a textbook and a chalkboard as a dominant tool. Tire & Mlitwa (2015) observed that more schools in the rural parts of South Africa operate under such conditions, lacking the necessary teaching-aids to support teaching and learning experiences. This challenges the teacher and further has an effect on the learners. In other words, the lack of modern teaching-aids to support learning in rural schools deprives learners of access to quality education. As a result, learners who are a product of these schools are mostly found to be incompetent with their urban counterparts (Heyneman,

50

2016:108). While most rural schools are still using yesterday's techniques to skill learners for the future, with the skills that are slowly losing value in the labour market. Evidence has shown some form of the use of ICT for teaching to some extent existing in some schools for the enhancement of the quality of education (Bai *et al.*, 2016:13). Zyad (2016:71) notes that teachers' attitudes of the use of ICT for teaching purposes are informed by the advantages associated with the use of ICT. Thus, the acceptance of technology by the teachers. According to Tamayo *et al.* (2017:112), the use of ICT for the enhancement of the quality of education has been noted and it has shown positive results. Thus, resulting in a blended form of instruction delivery (Sein-Echaluce *et al.,* 2017; Soler *et al.,* 2017).

According to Tayebinik & Puteh (2013), blended learning is a mixture of traditional classroom practice with technology use for educational purposes. Blended learning is the most flexible method of learning that enable instruction to take place even outside the classroom, resulting in improved learning outcomes. The proposed framework presented in Figure 5 suggests that merging ICT into traditional pedagogies in a rural classroom can result in the use of both traditional teaching methods and ICT, thus blended learning. This can be achieved through the assistance of the use of personal devices such as smartphones, in cases where the school lack ICT resources. This is consistent with   Howard *et al.* (2016:30) who reported that the use of smartphones in substitution of modern teaching resources has contributed to the improvement of classroom experiences. That is, the teachers, particularly from rural disadvantaged schools, have started to embrace the use of ICT for teaching practice through the use of smartphones and other personal technology devices (O'Bannon & Thomas, 2014:20). This indicates some degree of perceived usefulness of technology among teachers which can then motivate perceived ease of use, hence the desired state of this framework.

3.4.2 The Desired State

As presented in Figure 5, the desired state of this framework is to have a strong presence of ICTs usage in the classroom and less of the traditional teaching methods. Enforcing the effective use of ICT in a rural classroom as proposed by this study is also consistent with the national priorities of the country and even beyond, to enhance the quality of education through the digitisation of learning systems (Osakwe, 2017:16). The proposed framework suggests that establishing a blended form of teaching in a rural classroom would result in Perceived Ease of Use (PEOU). In relation to the diagram above, PEOU would mean that the teachers find the use of ICT more aiding in their teaching practice, resulting in the maximum use of technology in a rural classroom. As a result, more interaction between the teachers and their learners would emerge, leading into enhanced creation of information. Furthermore, such interactive would establish relationships between teachers and other colleagues from all over the globe for the goal of exchanging teaching material. This would ensure that learners are provided with a quality education that makes them relevant to the changing demands of the outside world, hence the fourth digital revolution and future changes.

3.4.3 The Future State

The proposed framework for this study illustrated in Figure 5 suggests an enhanced teaching in response to the Fifth Industrial Revolution. Reflecting back on the previous industrial revolutions, it can be seen that the migration from one revolution to the next is now becoming more narrow. The changes brought by the 4IR has given birth to new living dimensions which call for humankind to embrace ICT and learning institutions have to play a responsive role in this. As noted by Mckenzie (2017) that the Fourth Industrial Revolution would bring massive dislocations, at an unprecedented speed that makes it even "scary" to envisage the next revolution, the Fifth Industrial Revolution. The proposed framework suggests that the development process can start from basic education, advance to secondary

education and finally into higher education. This will help in creating a learning environment that promotes innovativeness, thus providing the relevant skills needed for the digital market space. This is significant because the learners who sit in the classroom today, hold the future. Therefore, it is important to try to find ways in which learners from the rural schools to cope with the changes brought by the digital revolution.

3.5 Conclusion

This chapter has presented two communication models, Technology Acceptance Model and Interactive Model used in this study. The chapter has related the models in the context of teaching and learning. TAM has been used to measure teachers' perceptions towards the use of ICT and the factors that affect the effective use of ICT for instruction in a rural classroom. Furthermore, the Interactive Model has also been employed to measure how learner involvement in the teaching process can add value to learner performance. The following chapter looks at the methodology of this study. The chapter discusses the research method and procedures employed in conducting this study.

C h a p t e r 4

RESEARCH METHODOLOGY

4. Introduction

This chapter discusses how the study was conducted, detailing the methods and procedures implemented to address a research problem. The chapter also outlines the procedures employed in the selection of participants, sampling and the collection of data. Furthermore, details on how data was collected using the questionnaire as a research instrument in this study are also included.

4.1 Study Area

The area in which this study will be conducted is the King Cetshwayo District Municipality (KCDM). The KCDM, previously known as uThungulu District Municipality is in the north-eastern region of the KwaZulu Natal Province. The KCDM is a, predominantly, rural region with about 80% of the population rural areas; with the third highest population in the province. It comprises of 5 local Municipalities that include:

- uMfolozi
- uMhlathuze
- uMlalazi
- Mthonjaneni
- Nkandla

Map of the King Cetshwayo District Municipality Locality
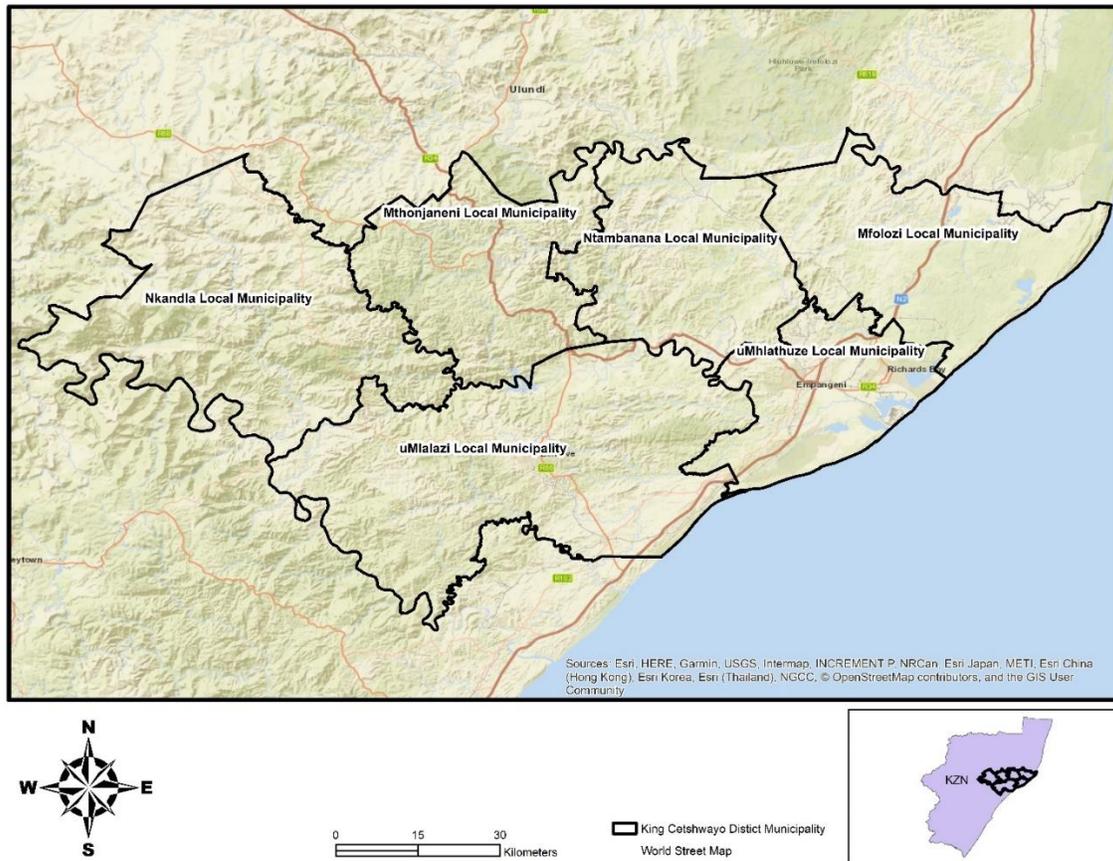
Figure 6: King Cetshwayo District Municipality Map
Source: KCDM Annual Report (2016-2017)

The selection of this study area was motivated by the District's mission; to promote quality education for all and striving for rural development (KCDM Annual Report 2016-2017), hence the study seeks to improve the quality of rural education. According to (KCDM Integrated Development Plan 2017/18-2021/22), the District's education state has raised serious concerns. Over the past years the District has been experiencing a troubling decline with regards to the pass rate, particularly at Basic Education level. Thus, this study aims to provide solutions to the District's education state.

4.2 Methodology

The researcher used both quantitative and qualitative research methods. According to Brynard *et al.* (2014:38) research methodology explains the various methods and processes employed by the researcher in obtaining scientific data. Research methods can be classified into two categories, qualitative and quantitative research methods (Walliman, 2018:79). According to Ragin & Amoroso (2011:172), quantitative research is a form of conclusive research based on hypotheses, in which generalisation can be made. While on the other hand, qualitative research is concerned with descriptions and content analysis (Merriam & Tisdell, 2015:13). Pajo (2018:252) also notes that while qualitative research is concerned with deeper understandings of a phenomenon, quantitative research method emphasises the statistical presentation of data (Adams & Lawrence, 2015:78). Palinkas *et al.* (2015:534) adds that the quantitative method is mostly used to test a hypothesis and is the preferred method for generalising. The researcher usually collects data from a sample that is representative of the population. Thus, the quantitative and qualitative research design was suitable for this study because the results will be generalised for rural secondary schools within the KCDM.

According to McAdoo (2015:55), there are two types of sources used to conduct research, which are primary source and secondary source. While secondary research, also secondary source, is consent with the interpretation, synthesizing and reporting of already existing data (Gray, 2018:565); primary research focuses mainly on original or first-hand data (Walliman, 2018:78). Primary research typically includes interviews, observations, live performance and eyewitness. Hence, in this study, respondents (teachers) report on their professional experiences based on their everyday observation in the classroom. Rubin *et al.* (2010:219) note various methods that can be used to collect data using these sources. Data can be collected through personal interviews, telephone interviews, mail questionnaires and self-administered surveys. But before embarking on these methods, the

elements of the study or research participants must be carefully identified through the correct sampling of participants from the entire population.

4.3 Population and Sampling

According to Gray (2018:147) population is a total number of the study participants from which a sample is drawn. Blanche *et al.* (2006:49) define sampling as the selection of the elements or participants of the study from the entire population (Biswas & Zhang, 2018:2). The sampling paradigm can be categorised into two categories, namely, probability and non-probability sampling (Welman *at al.,* 2005:56; Gorard, 2013:78). Palinkas *et al.* (2015:534) emphasises that sampling should be consistent with the aim of the study. The researcher, therefore, needs to ensure that the elements or participants selected to participate in the study serves the purpose of the study. Kandola *et al.* (2014:15) also highlight the importance of understanding the entire population before sampling decisions are made. Understanding the population helps the researcher to select the relevant sample for the study. Edmonds & Kennedy (2017:20) further explain sampling categories, indicating that probability samples entail simple random samples, stratified random samples, systematic samples and cluster samples. Whereas non-probability samples are as follows: quota samples, purposive samples, snowball samples, self-selection samples and convenience samples.

Pertaining to this study, the study aimed at studying rural schools, hence, the selecting of the King Cetshwayo District Municipality as the study area. The KCDM is a predominantly rural region comprising what is faced with the high rate of unemployment and high level of poverty (KCDM Integrated Development Plan, 2017), of which Novotný *et al.* (2015:22) described unemployment and poverty as traits associated with the rural definition. In addition, the information provided by the district office on which categories of schools helped in identifying rural schools.

Rural schools were, then, randomly selected to participate in the study. Convenience sampling technique was used to select the study participants (teachers) in each school. According to Etikan *et al.* (2016:2) convenience sampling (also known as haphazard sampling) is a carefree method of sampling elements or participants from the population, in which no system is followed (Neuman, 2009:88). Beaudry & Miller (2016:105) also note that a convenience sample is a non-probability sampling technique that selects participants based on their willingness to participate in the study, easy accessibility or availability. This kind of sampling often yields quality data as it deals with willing participants (Brink *et al.,* 2012:139). Thus, the use of a convenience sample in this study is to gather high-quality data for the validity and reliability of the study. Since the study was limited to a district, convenience paradigm was, therefore, suitable as it enabled the researcher to gather data in a given time of this study. The selection of convenience sampling for this study also enabled the researcher to select members of the population based on accessibility and geographical proximity.

4.4 Data Collection Procedure

Data collection procedure details various systematic techniques employed by the researcher to collect data Ragin & Amoroso, 2011:28). Pajo (2018:170) maintains that a researcher needs to pay careful attention to the method of data collection in order to correctly transform information gathered into measurable units that can be analysed. Methods of data collection include surveys, observation or interviews. According to Edmonds & Kennedy (2017:133), a survey approach is a data collection approach that usually selects participants randomly, in which generalizations can be made. Berger (2016:294) adds that survey is a popular method of collecting data in various disciplines, mostly in social sciences. Usually, surveys rely on questionnaires as an instrument for data collection.

With reference to this study, a survey method of data collection was employed. According to Berger (2016:290), a survey is a research method used to gather and analyse information from a sampled group of study participants, representative of a larger group of subject interest. The survey research method is most effective in understanding people's attitudes, beliefs and values (Edmonds & Kennedy, 2017:133), and it is mostly recommended for collecting data from a larger sample (Beaudry & Miller, 2016:107); thus, the selection of the survey method for this study. From the above, the survey approach fulfils the aim of this study and further provides recommendations regarding the use of ICT for instruction within a rural classroom.

In this study, data were collected from rural secondary school teachers of 11 different schools within the KCDM. Initially, the researcher anticipated working with only four schools. However, due to the poor turnout where a larger number of teachers from previously identified schools who chose not to participate in the study, due to their busy schedule of setting test papers, marking, invigilating and trying to meet submission deadlines, more schools were then approached to participate in the study. Welman *et al.* (2005) note that it is common for a researcher to deviate from the origins of the planning of the research in order to meet the aim of the study. Devlin (2006:54) is also in support of the idea of adjusting the sample size in order to meet the aim of the study. Hence, increasing the number of schools to participate in this study. A new approach of targeting at least two rural schools in each municipality within the KCDM was set out. In this regard, the researcher was successful in achieving the target of two schools in each municipality. This was, however, achieved after facing several challenges.

In this study, data were collected over a period of six weeks. After the schools were selected to participate in this study, appointments with the school principals were scheduled. On the first appointment, the researcher met with the school principal to seek the consent of accessing the school. After that appointment, another visit would then be scheduled for the research to disseminate the questionnaires to the teachers. In some instances, the researcher

was given a platform to address the teachers and explained their involvement in the study. This approach was very effective as the researcher interacted with the participants and the participants had a chance to question more about the study and their involvement in it. In other instances, the researcher only met with the school principal and explained the study, and the principals also assisted in conveying the message to the teachers. In most of the schools, the researcher visited the schools on three occasions. The first being the appointment with the principals, followed by dissemination of the questionnaires, and then the collection of the questionnaires. This was, however, not an easy task as travelling costs were involved and it was time-consuming as well. In some other schools, the researcher's task was made easy as the teachers chose to fill in the questionnaire on the day of dissemination. This also worked out well as it gave an opportunity to clear any ambiguities pertaining to the study.

4.5 Questionnaire Design

According to Walliman (2018:110), a questionnaire is a set of questions aimed at gathering information to a certain group of people. For Pajo (2018:161), a questionnaire is a data collection instrument that pertains a set of written questions. Boynton (2004:1313) and Kothari (2004:45) indicate that questionnaires can be categorised into two forms; which include a non-standardized survey questionnaire and standardized survey questionnaire. The non-standardized survey questionnaire is a kind of questionnaire that has not been tested, while standardized survey questionnaire has been tested and reliable for data collection. Boynton (2004:1313) also notes that standardized questionnaire follows the order of asking participants the same questions. In this order, the same questions are written and administered to the participants, which is the greatest advantage of the questionnaire (Brynard *et al.,* 2014:48). Furthermore, Berger (2016:290) states that the use of the questionnaire to collect data is ideal for a larger sample, and the questionnaire also gives participants a chance to carefully think through the answers to the questions, which contributes to the validity of the data they provide.

Pertaining to this study, a standardized questionnaire was used. A set of questions were carefully crafted to collect data from secondary school teachers. These questions were categorised into two sections. Section A, pertaining background information; and section B consisting of questions which were to be answered using a Likert scale. This kind is effective and not time-consuming, which can also increase participation. In addition, the cover sheet of the questionnaire included notes to participants. These notes to participants detailed the purpose of the study as well as notes on how to fill in the questionnaire. Also, the cover sheet of the questionnaire included a coding section (to be used by the research) which was useful in the analysis of data. Berger (2016:295) emphasises the importance of this kind of cover sheet by noting that questions should be accompanied by a cover letter, detailing the purpose of the study and explaining what is expected from the participant.

4.6 Data Analysis

Walliman (2018:131) support Welaman *et al.* (2005:210) that at this juncture, after the selection of the appropriate research design, then the need arises for the selection of an appropriate statistical procedure to analyse the data. Lindlof & Taylor (2011:2430) maintain that this is a crucial aspect which gives focus to the entire study. At this stage of the study, the researcher gives meaning to the raw data collected using coding as well as grouping of a similar theme (Walliman, 2018:98). According to Brynard *et al.* (2014:62) the data analysis stage is the stage of eliminating irrelevant data by means of data filtering, and the coding of data becomes useful at this stage (Edmonds & Kennedy, 2017:324).

4.6.1 Coding

Edmonds & Kennedy (2017:325) explain coding as the process of categorising, marking or labelling data. In this regard, data can be categorised in a form of grouping similar themes and ideas together in order to help in managing the information and make it possible to retrieve it at a later stage. Walliman (2018:97) agrees with Welman *et al.* (2005:213) that coding helps in managing the huge amount of data to assist the researcher to make sense of

this data. Lindlof & Taylor (2011:248) adds that coding is a fundamental aspect that links data.

With reference to this study, the researcher worked with voluminous data, therefore, coding was a useful technique for sorting data gathered. Over one-hundred questionnaires were collected, the researcher then labelled each questionnaire in numbers. Each question was coded numerically in order to make it easier to group them, accordingly, making it possible to capture it for analysis purposes. In this study, data were analysed using a statistical computer software called IBM SPSS Statistics, Version 25. The data was first captured into Excel, for reliability reasons, and then transferred into the SPSS software. Edmonds & Kennedy (2017:220) recommends the use of data analytic software at this stage. Thus, the selection of the IBM SPSS Statistics software.

4.7 Conclusion

This chapter has elaborated on the methods and procedures employed in this study. The section has detailed the steps followed in selecting the population of the current study and sampling decisions. Furthermore, details on the structuring of the questions that were answered by the participants have also been highlighted. As well as the statistical processes of converting the raw data collected from the participants into meaningful data. The next chapter focuses on the conceptual framework of this study, using two models to highlight the communication role in this study.

C h a p t e r   5

RESULTS AND DISCUSSION

5. Introduction

This chapter focuses on the analysis and discussion of the data collected through the questionnaires administered. The aim of the study is to investigate how the use of Innovative Communication Protocols in the classroom can assist teachers in rural secondary schools. The questionnaire was divided into five sections, which include the demographic features, the extent of ICT exposure among teachers, as well as one open-ended question on the respondents' suggestions. The analysis of data is presented graphically using tables and graphs, which are tabulated in percentages for ease of interpretation. The data were analyzed using the IBM SPSS Statistics, version 25. The findings are presented under each research methods and a summary is thereafter provided.

5.1 Data Analysis and Interpretation

This section uses graphs and tables to presents summaries of the results. The section is sub-divided into four, comprising of the demographics and findings in accordance with the three objectives of this study. Data is analyzed under the following headings:

- Demographics
- The Extent of ICT Usage among Teachers
- Teacher's Perspectives on the Use of ICT for Classroom Instruction
- Barriers to The Use ICT in Education

5.1.1 Demographics

This section pertains respondents' gender, age distribution, teaching experience, levels taught and the number of learners in the classroom. The results are as follows:
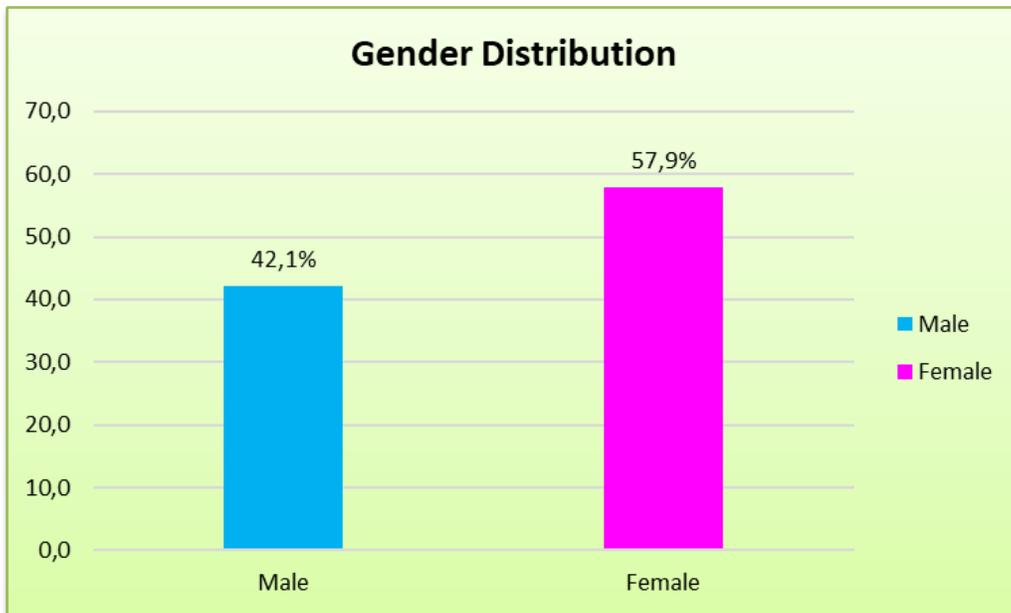
Figure 7: Gender distribution of respondents

The result as presented in Figure 7 shows that both genders were adequately represented in the survey. A total of 70 (57.9%) of the respondents were females and 51 (42.1%) of the respondents were males. That is, most respondents in this study were females.
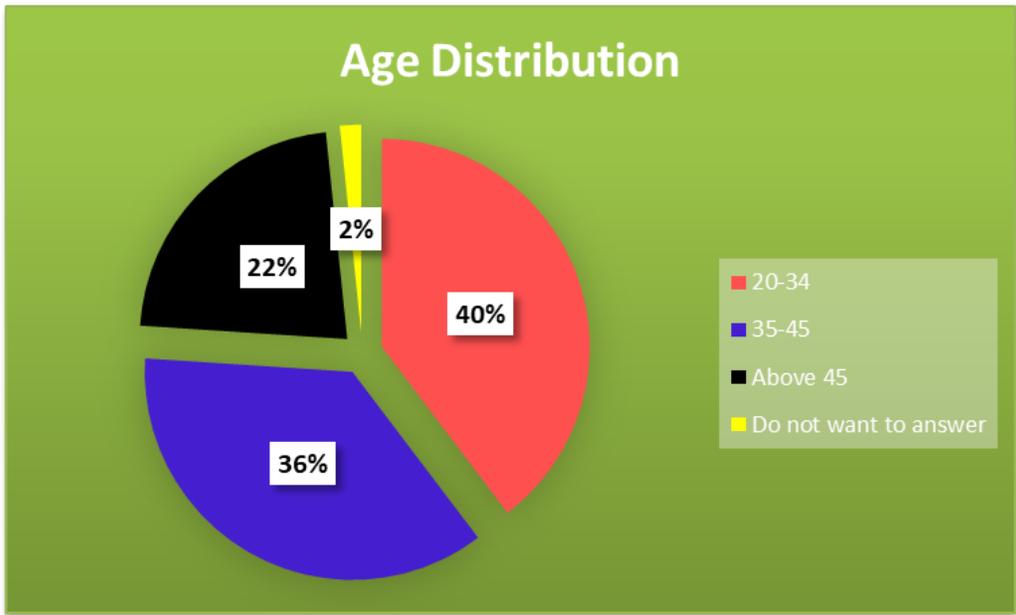
Figure 8: Age distribution of participants

From the results presented in Figure 8, 48 (40%) of the respondents were aged 20-34, followed by 44 (36%) aged 35-45, 27 (22%) aged above 45 and 2% of the respondents did not want to answer the question. The results on age distribution, as presented in Figure 8 indicate that all ages were represented in this study. Also, the results indicate a slight difference in age distribution between ages 20-34 and 35-45, making the age group of 20-34 years most participants for this study.
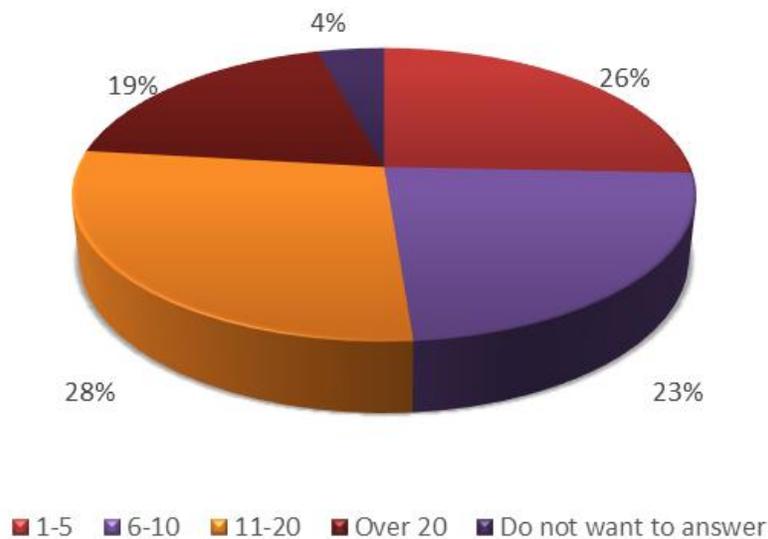
Figure 9: Teaching Experience

From the result presented in figure 9, 34 (28%) of the respondents have 11-20 years teaching experience, followed 1-5 years teaching experience 31 (26%), 6-10 years teaching experience (23%), over 20 years teaching experience 23 (19%), and others that did not want to answer this question constitute only 4% (5) of the entire respondents. The results depict that most respondents who participated in this study have just recently entered the field of teaching. Respondents who have 1-5 years' experience could be developed into using innovative technology for teaching.

Table 1: Class level

Variable	Frequency	Percent	Valid Percent	Cumulative Percent
Lower level (grade 8-9)	30	24.8	24.8	24.8
Upper level (10-11)	65	53.7	53.7	78.5
Both 1 & 2	26	21.5	21.5	100.0
Total	121	100.0	100.0	

Table 1 presents the level taught by the respondents. The results revealed that the majority 65 (53.7%) of the entire respondents teach the upper level (grade 10-11), 30 (24.8%) teach the lower level (grade 8-9), the remaining 26 (21.5%) teach both upper level (grade 10-11) and lower level (grade 8-9).

Table 2: Average number of learners in a classroom

Variable	Frequency	Percent	Valid Percent	Cumulative Percent
25-33 learners	11	9.1	9.1	9.1
34-40 learners	27	22.3	22.3	31.4
Above 40 learners	75	62.0	62.0	93.4
I do not want to answer this	4	3.3	3.3	96.7 100.0
Both 1 & 2	4	3.3	3.3	
Total	121	100.0	100.0	

The respondents were asked the average number of learners they teach in each classroom. The results in Table 2 reveal that 75 (62.0%) of the respondents indicated that they teach more than 40 learners per class, followed by 27 (22.3%) who have 34-40 learners in a classroom, 25-33 learners 11 (9.1%), both 1 and 2 (3.3%), and the respondent who did not answer these questions, 3.3%. A conclusion can therefore be drawn that most respondents who participated in this study teach a larger number of classes.

5.1.2 The Extent of ICT Usage among Teachers

This section presents the findings of the first objective of this study. The results are as follows:
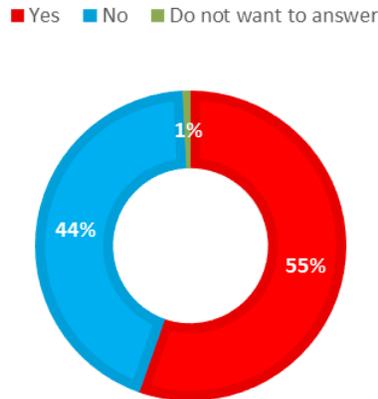
Figure 10: Availability of ICT resources in schools

The respondents were asked if their schools are equipped with ICT facilities such as computers and Internet access. From the results as presented in Figure 10, it was established that 55% of the respondents indicated that their schools have either computer, Internet access or both. While 53 (44%) indicated that their schools are not equipped with ICT facilities, and the remaining 1% did not answer the question. The results indicate that efforts have been made in developing rural schools technically. However, 44% is still a large percentage that indicated that they are still excluded from ICT developments. Nyahodza & Higgs (2017:46) are in consensus with the view that bridging the digital divide in the learning institutions in South Africa, particularly in disadvantaged schools, has been of high interest and successful in certain parts of the country. However, there is still a great need in availing ICT resources in disadvantaged areas. Padayachee (2017:51) also maintains that there is still a shortage of ICT resources in South African secondary schools.
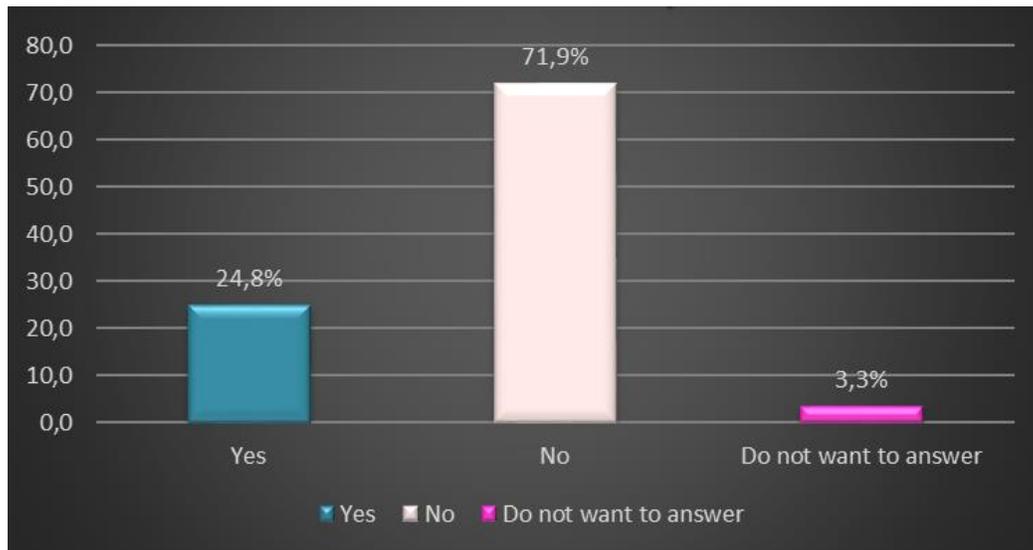
Figure 11: Teacher ICT development

In response to the question on whether the respondents receive any kind of ICT training from either their schools or the department; the majority 87 (71.9%) of the respondents indicated that they do not get any form of ICT training, 30 (24.8%) indicated that they have benefited from ICT training from either their schools or through the department, and the remaining 4 (3.3%) did not answer this question. It is clear that something needs to be done with such a high percentage (71.9%) of teachers lacking ICT skills for education purposes. Umar *et al.* (2014:984) affirm that skilling the teachers with ICT skills remains a challenge that limits the use of ICT for teaching purposes. That is, there is a significant difference in the use of ICT for teaching purposes and using ICT for socializing, thus the importance of providing relevant ICT skills for classroom use.
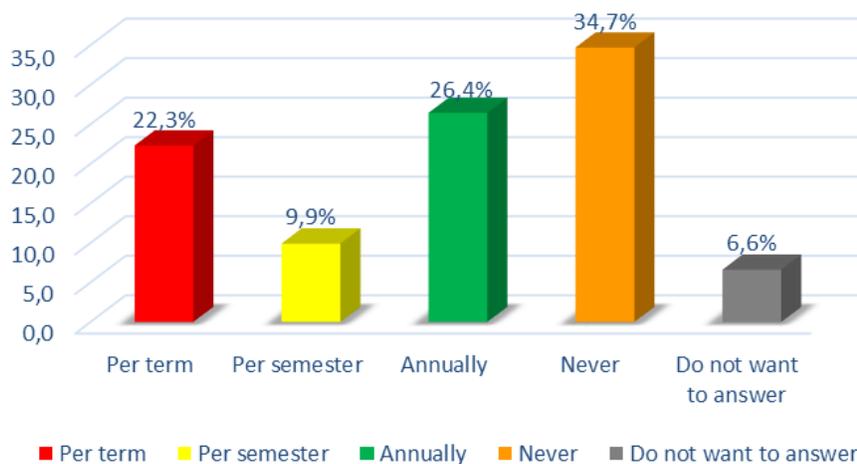
Figure 12: Frequency of ICT training among teachers

The respondents were asked how often the school provides professional development opportunities, such as ICT training. The following responses were obtained from the respondents; 42 (34.7%) have never received any ICT training, followed by 32 (26.4%) who indicated that the receive ICT training at least annually, 27 (22.3%) who said they receive ICT training per term, 12 (9.9%) who get training per semester, and 8 (6.6%) did not answer the question (*See Figure 12*). The response by the majority of the respondents shows that their school never provides professional development opportunities such as training, which confirms their opinion in Figure 11 that their school does not provide ICT training for their teachers. Bellini *et al.* (2016:54) also found that digital incapability limits the use of ICT. Thus, the importance of regular ICT training for teachers in order to promote the use of ICT in their professional practice (Tondeur *et al.*, 2018:39).

Table 3: Ability to produce typed documents

Variable	Frequency	Percent	Valid Percent	Cumulative Percent
Good	68	56.2	56.2	56.2
Fair	33	27.3	27.3	83.5
Poor	19	15.7	15.7	99.2
I do not want to answer this	1	.8	.8	100.0
Total	121	100.0	100.0	

From the results presented in Table 4 above, 68 (56.2%) of the respondents believe that they are good in producing typed documents using ICT, followed by fair 33 (27.3%), poor 19 (15.7%), while the remaining 1 (0.8%) refrained from answering the question. The results indicate that most respondents have access to ICT, one way or another. In relation to the responses provided on Figure 11 and 12, it can be concluded that the respondents may not be getting ICT training for professional practices from their schools but they somehow find a way to equip themselves with ICT skills. This suggests that most respondents are willing to embrace ICT.

Table 4: Ability to produce PowerPoint presentation for teaching

Variable	Frequency	Percent	Valid Percent	Cumulative Percent
Good	33	27.3	27.3	27.3
Fair	31	25.6	25.6	52.9
Poor	53	43.8	43.8	96.7
I do not want to answer this	4	3.3	3.3	100.0
Total	121	100.0	100.0	

The result, as presented in Table 4, shows how the respondents are comfortable with using ICT for PowerPoint presentations during teaching. Most respondents, 53 (43.8%) indicated that their level of PowerPoint application is poor, while a low percentage of 27.3% (33) believe that their level of PowerPoint presentation is good, and the remaining 4 (3.3%) refrained from answering the question. This concludes that there is a significant difference in the basic use of ICT and the use of ICT for instruction delivery. Therefore, training teachers for the use of ICT for teaching remains of high importance and has a direct impact on the use. In consensus to this finding is Umar *et al.* (2014:982) who explored the level of ICT skills and practices, and its impact on teaching and learning. The study found that most teachers are ICT capable, but very few of them use ICT for their professional practice due to the lack the skills to enable them to deliver instruction using ICT.

Table 5: Ability to search for information on the Internet

Variable	Frequency	Percent	Valid Percent	Cumulative Percent
Good	72	59.5	59.5	59.5
Fair	24	19.8	19.8	79.3
Poor	23	19.0	19.0	98.3
I do not want to answer this	2	1.7	1.7	100.0
Total	121	100.0	100.0	

The result as presented in Table 5 reveals that the respondents are comfortable with using ICT to search for information on the Internet. This was indicated by the majority of 59.5% who believe their extent of using ICT to search for information on the Internet is good, followed by 19.8% who indicated fair, 19% indicated poor, and 1.7% did not answer the question. Mutua & Ng'eno (2016:32) also found that ICTs are rich in useful material that has the potential to enhance teaching experiences. However, most teachers from rural underdeveloped schools cannot benefit from such developments due to skills inadequacy.

Table 6: Ability to produce graphs and illustrations for teaching purposes

Variable	Frequency	Percent	Valid Percent	Cumulative Percent
Good	33	27.3	27.3	27.3
Fair	33	27.3	27.3	54.5
Poor	54	44.6	44.6	99.2
I do not want to answer this	1	.8	.8	100.0
Total	121	100.0	100.0	

The respondents were asked the extent to which they are comfortable with using ICT to produce graphs and illustrations for teaching purposes. From the result as presented in Table 6, 54 (44.6%) of the respondents said their level of ICT for producing graphs is poor, 33 (27.3%) indicated good, the other 33 (27.3%) said their level of ICT for producing graphs and illustrations is fair, and 1 (0.8%) did not want to answer the question. It can, therefore, be concluded that most of the respondents who participated in this study are versed with just the basics of ICT, such as typing (*see Table 3*).

Table 7: Ability to send email

Variable	Frequency	Percent	Valid Percent	Cumulative Percent
Good	47	38.8	38.8	38.8
Fair	34	28.1	28.1	66.9
Poor	38	31.4	31.4	98.3
I do not want to answer this	2	1.7	1.7	100.0
Total	121	100.0	100.0	

The result as presented in Table 7 reveals the respondents' level of ICT use for communication purposes. Most of the respondents in this study (38.8%) said they are good in communicating via email with other teachers, 31.4% indicated that their ability to communicate with other teachers using email is poor, 28.1% indicated fair, and 1.7% said they do not want to answer the question.

Table 8: Ability to send files/documents to others

Variable	Frequency	Percent	Valid Percent	Cumulative Percent
Good	58	47.9	47.9	47.9
Fair	28	23.1	23.1	71.1
Poor	33	27.3	27.3	98.3
I do not want to answer this	2	1.7	1.7	100.0
Total	121	100.0	100.0	

Table 8 shows the respondents' level of ICT capability about sending documents. The results indicate that most respondents (47.9%) believe that they are efficient in sending files or documents to others, while 27.3% indicated poor, 23.1% indicated fair, and the remaining 1.7% refrained from answering the question. The results confirm that respondents are at their introductory phase of ICT use (*see Tables 3 and 6*).

Table 9: Teaching aids available in schools

Variable	Frequency	Valid Percent
10.1 Chalkboard	121	100
10.2 Projector	65	53.7
10.3 Television	21	17.4
10.4 Radio	10	8.3
10.5 Flipcharts	39	32.2
10.6 The Internet	32	26.4
10.7 Textbooks	117	96.7
10.8 eBooks	1	0.8
10.9 Posters	38	34.4

Table 9 presents the teachings-aids available in the schools. The result shows that all the respondents (100%) stated that they have chalkboards in their schools. This affirms that chalkboards are basic teaching aids in most school. Followed by textbooks with 96.7%, projectors with 53.7%, posters with 34.4%, and flipcharts with 32.2%. Only 26.4% indicated that their schools have Internet access, suggesting that others are Internet (26.4%), television (17.4%), radio (8.3%), and eBooks with 0.8 percent. Focusing on the availability of innovative communication protocols in these schools, the availability of the Internet and other modern learning technology is very minimal. It can, therefore, be concluded that rural schools lack teaching and learning-aids of modern times. This finding is supported by Tire & Mlitwa (2015:152) who found that rural schools remain

underdeveloped and suffer from the lack of teaching and learning-aids to improve their classroom experiences.

5.1.3 Teacher's Perspectives on the Use of ICT for Classroom Instruction

The following section presents findings in relation to the second objective of the study. The results are as follows:
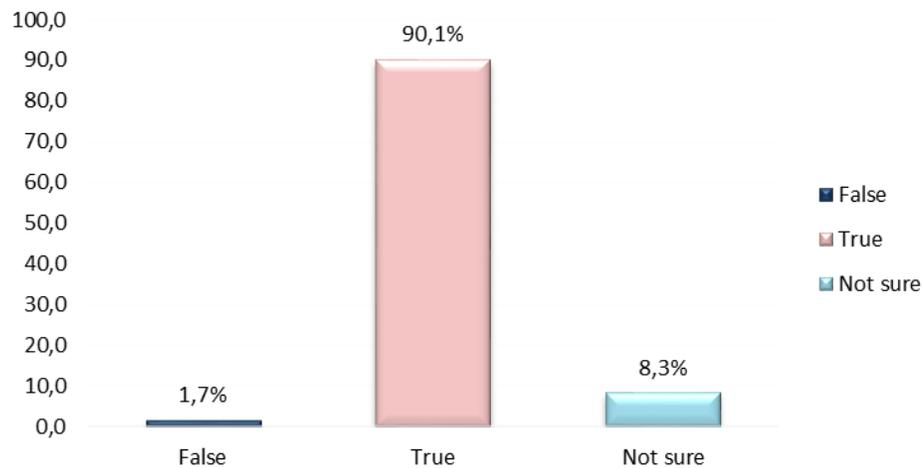
Figure 13: ICT as a positive change in class

The respondents were asked whether they believe that the use of ICT for teaching and learning purposes would bring positive change in the classroom. From the result as presented in Figure 13, it was established that a great proportion of respondents (90.1%) agreed that the use of ICT for teaching and learning would bring positive change in the classroom, while a minority of 1.7% disagreed that the use of ICT in the classroom can be rewarding, and 8.3% were not sure.

This shows that teachers believe that the use of ICT in the classroom has the potential to contribute positively to the performance of the learners. However, comparing these results in Figure 16 and Table 9, it can be concluded that the availability of resources is a barrier that hinders the use of ICT in the classroom. That is, teachers show positive attitudes towards the use of ICT for instruction delivery; however, the lack of ICT facilities is a challenging factor. In addition, the respondents further highlighted on the open-ended question that, indeed, the use of ICT in the classroom can bring positive change, given its greatest advantage of being free from time and space restrictions. This would mean that learners can continue with the learning process even outside of the school premises. Furthermore, because learners relate to ICT better, teachers also see this as an advantage to them as learners would be encouraged to spend more time studying and further establish robust discussions with their peers. In this sense, learners can exchange learning material with their peers from all over, thus, bridging the gap of the lack of learning materials in some schools.

This finding is supported by Adukaite *et al.* (2017:180) who also found that most teachers believe that the use of ICT in the classroom has the potential to enhance teaching and learning experiences and further contributes to learner outcome. However, there are other factors that raise concerns to the teachers (Hsu, 2017:27).

Table 10: ICT as a disruption

Variable	Frequency	Percent	Valid Percent	Cumulative Percent
False	73	60.3	60.3	60.3
True	20	16.5	16.5	76.9
Not sure	28	23.1	23.1	100.0
Total	121	100.0	100.0	

In response to the question whether the use of technologies in the classroom would bring distraction, the majority 70 (60.3%) of the respondents disagreed that using technologies in the classroom would bring distraction, while 23.1% were not sure, and the remaining 16.5% agreed that the use of ICT in the classroom would be a distraction. This shows that the teachers believe that ICT would be useful for instruction delivery in a rural classroom. From the findings presented in Table 10, it can be noted that teachers share mixed feelings about learners being exposed to ICT. Palomino (2017) is also of the view that teachers perceive the use of ICT in the classroom as an initiative that carries both the good and bad, in particular to the learners (Copriady, 2015).

The qualitative aspect of this study also affirms that the use of ICT in the classroom has its pros and cons. There were concerns noted with regard to the use of ICT in the classroom. The teachers noted that the aforementioned advantages of ICT in the classroom can only bring fruition if correctly used. In other words, ICT carries both positive and negative effects, the choice of taking advantage of ICT for the good lies upon the user. Thus, teachers are concerned that when learners use technology unmonitored, they may use it for other activities outside of learning. Noted concerns include learners being addicted to social media and having access to ICT in schools may distract them as they may tend to get carried away by

the entertaining aspect of technology. According to Tondeur *et al.* (2017:561) the possible solution to this would be scaffolding learning. This then concludes that the use of ICT in the classroom can yield better results if the learners are well monitored when using it.
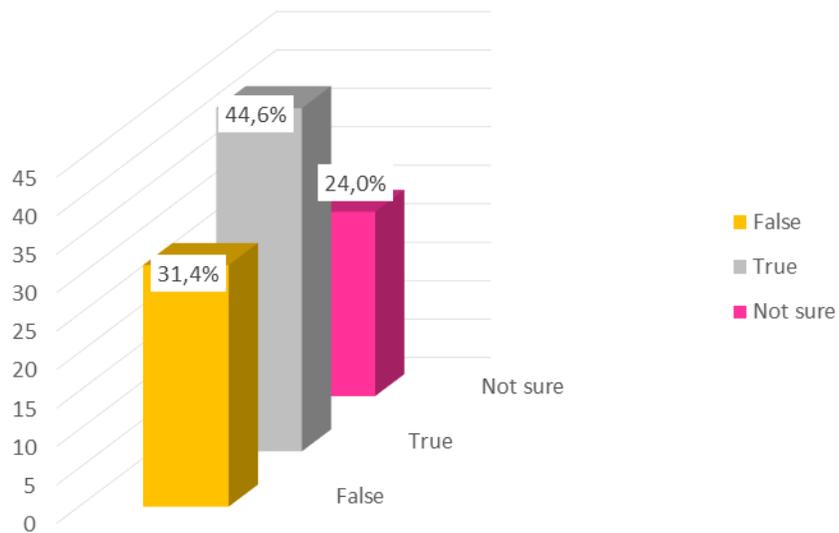
Figure 14: Disadvantages of ICT in class

The respondents were asked whether they believe that the use of ICT in the classroom would have a negative effect on learners' writing skills. The results as presented in Figure 14 show that 44.6% of the respondents believe that ICT would diminish learners' writing skills, followed by 31.4% who disagreed that the use of ICT in the classroom would have a negative effect on the learners' writing skills, and 24% said they are not sure. This concludes that the use of ICT in the classroom may have a negative effect on learners' writing skills. In comparison to the results presented in Figure 13, that ICT would bring positive change in the classroom, it can be concluded that there are mixed feelings concerning the use of ICT in the classroom. While teachers feel that the use of ICT for classroom instruction would positively influence teaching and learning activities, teachers

are concerned with the impact that ICT would bring to learners' personal development. Scherer *et al.* (2015:204) also found that teachers are more concerned with the impact of ICT in learners' writing skills, thus it is one of the variables used to measure teachers' perceived usefulness of ICT in teaching and learning.
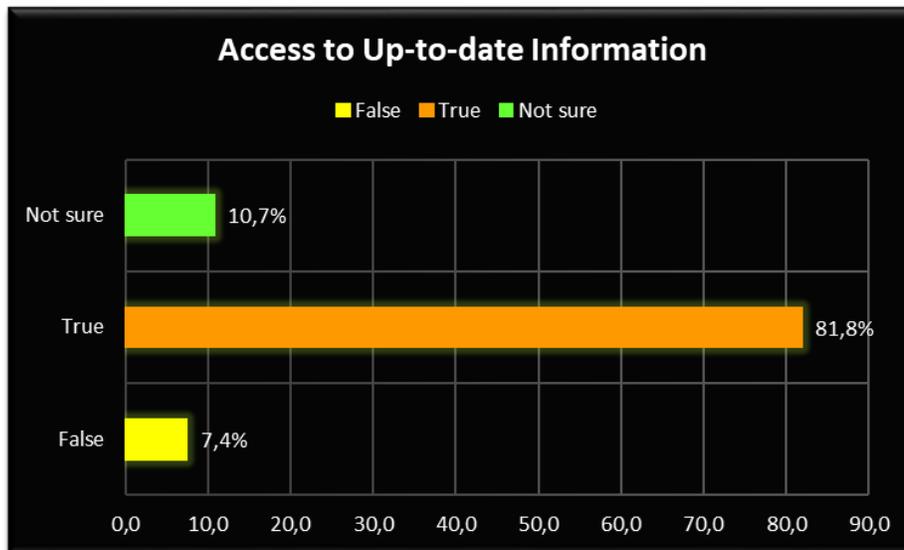
Figure 15: Information access

In response to whether the respondents think that the learners would benefit from the use of ICT in the classroom by accessing up-to-date information that may improve their performance, the results are presented in Figure 15 depicting that 81.8% agreed that the use of ICT in the classroom would benefit learners with current and updated learning material that can improve their attainment, while a low 7.4% of respondents disagreed that learners can benefit from learning material availed by ICT, and 10.7% indicated "not sure" to the statement. It can, therefore, be concluded that most teachers feel that ICT is rich of up-to-date information needed by the learner in order to improve their learning performance. This finding is supported by Al-eidan (2017:48) and Islam (2013:396) who evaluated the advantages of the use of technology in the classroom, and reported that teachers share positive beliefs on the use of ICT. The teachers indicated that they believe

learners benefit from ICT by accessing current and updated learning materials which contributes to their performance. To & Tang (2018:2) used the extended Technology Acceptance Model to evaluate the use of ICT in education and noted that ICTs are rich in up-to-date learning materials and therefore learners have the potential to improve learning experiences.
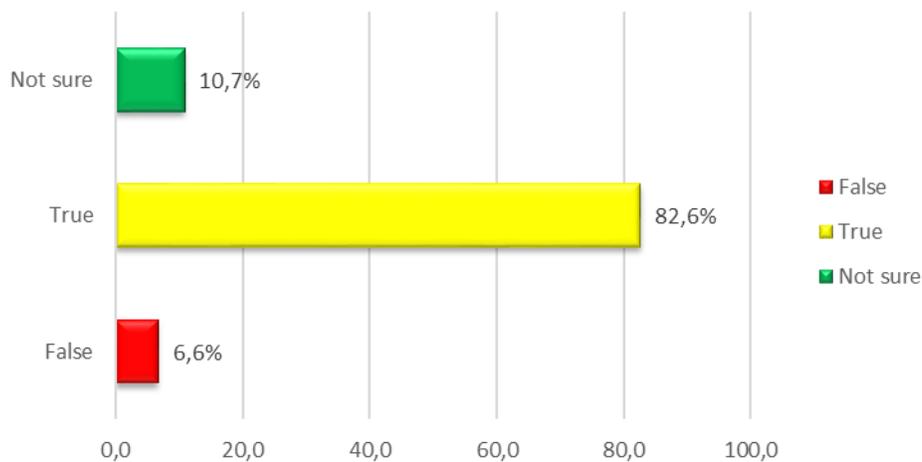
Figure 16: Learner participation graph

Figure 16 illustrates teachers' views on whether they believe that technology-enhanced classroom environments can motivate learner participation. The results show that 82.6% of the respondents affirmed that technology-enhanced pedagogies have a potential to encourage high participation of learners in the classroom, while 6.6% disagreed that learner participation in classroom activities can be informed using ICT in the classroom, and 10.7% answered: "not sure". This concludes that teachers believe that technology-enhanced pedagogies enable interaction between the teachers and the learners, which motivates learners' participation in the classroom. This finding corresponds with the findings of the study conducted by Brown (2017:61), which indicate that technology enhanced-pedagogies have the capacity to build on learners' thinking skills, thus enabling them to contribute to classroom activities. Thus, most teachers reported that their frequent

use of ICT in the classroom is motivated by the ability of ICT to actively involve learners in activities (Kearney *et al.,* 2015:58). Goodwin *et al.* (2015:144) assessed teachers' perceptions on the use of ICT in the classroom and reported that teachers indicated that learners enjoy using media, hence their improved participation in technology-enhanced pedagogies. Lin (2017:23) adds that ICT encourages high interactions among learners and their teachers, resulting in improved classroom experiences.
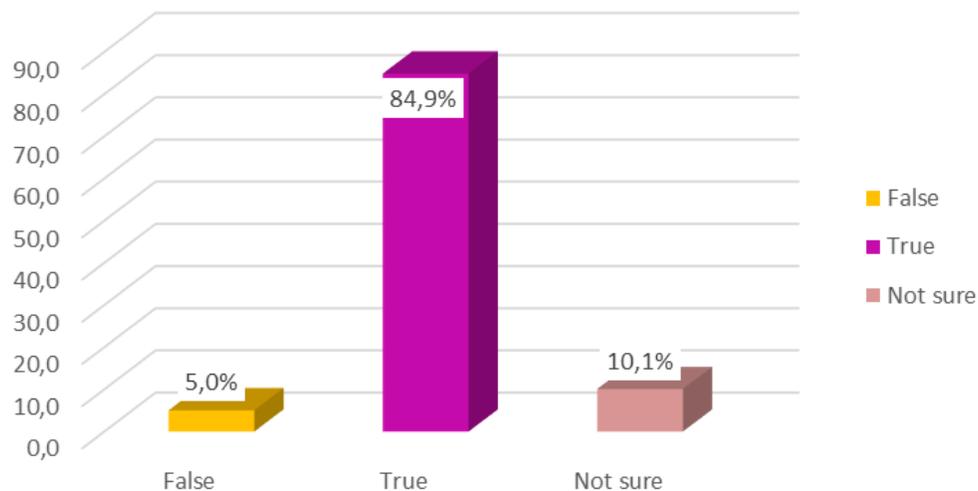
Figure 17: The use of ICT for lesson preparation

The results as presented in Figure 17 illustrate teachers' views on whether ICT can assist them with the lesson plan. The results show that 84.9% of the teachers who participated in this study feel that ICT can help them plan their lessons better, followed by a low percentage of 5.0% who do not think ICT would be useful in preparing their lessons, and 10.1% neither agree nor disagree. It can, therefore, be concluded that the majority of teachers strongly believe that ICT would be useful in their professional practice. This finding is consistent with Lee & Lee (2014:127) who concluded that teachers find

technology useful and it provides them with relevant information that enhances their classroom practices.
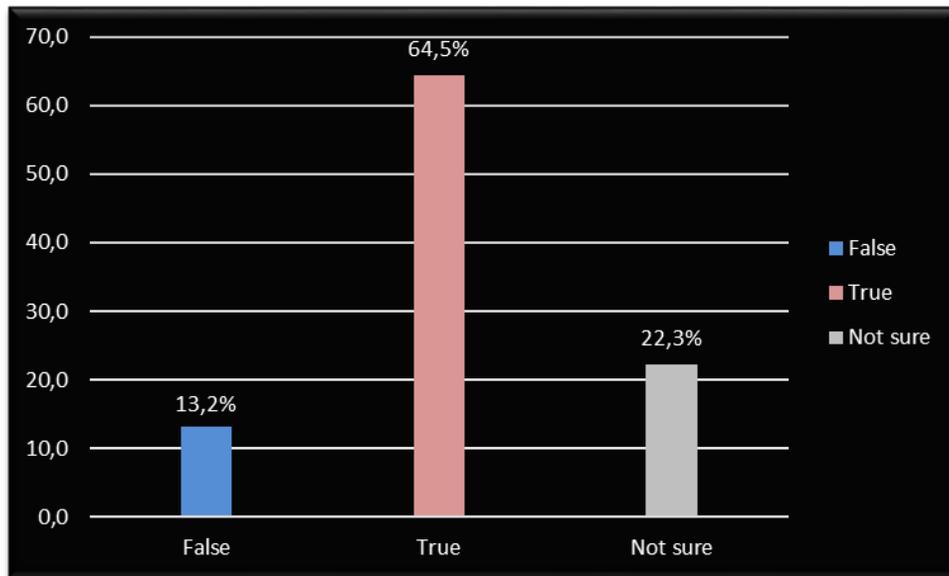
Figure 18: The ability of ICT to identify learners at risk

The respondents were asked whether they believe that the use of ICT for instruction delivery would help in identifying and addressing learners' individual needs. The results as illustrated in Figure 18 show that the majority of 64.5% of the respondents indicated that they believe that the use of ICT for classroom instruction would be very helpful in identifying different needs of the learners and further assist these learners, while on the other hand, 13.2% of the teachers do not think ICT can assist in addressing learners' individual needs, and the remaining 22.3% of the respondents indicated they were not sure. The results as presented in Figure 18 suggest that teachers think that ICT can help improve learner performance by identifying learners at risk, and further provide solutions to assist these learners. Pavel *et al.* (2015:707), however, found to the contrary. In their study, they

found that certain teachers are concerned with face-to-face contact. Their study concluded that technology-enhanced pedagogies lack face-to-face interaction between the teacher and the learners − as a result teacher are unable to read the learners' non-verbal cues.
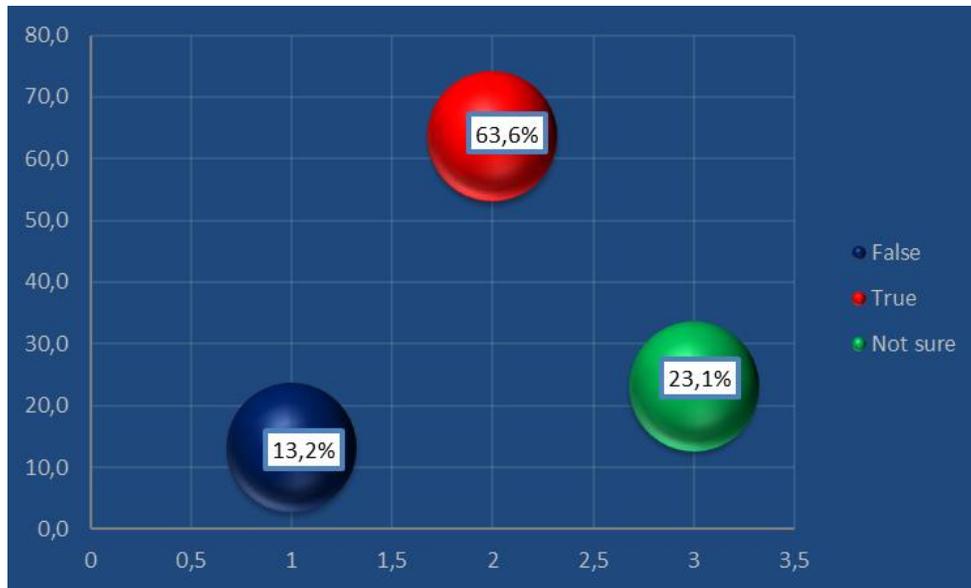
Figure 19: ICT as an effective communication tool

Figure 19 provides responses on whether the teachers perceive the use of ICT for the delivery of instruction as an effective tool to communicate with the learners. The findings show that 63.6% of the respondents agreed that ICT can be an effective communication for learning purposes, while 13.2% disagreed that ICT can help the teachers to communicate with the learners effectively, and 23.1% answered: "not sure". This concludes that indeed the use of ICT in the classroom can bring improved communication between the teachers and learners. This is supported by Miniawi & Brenjekjy (2015:1480) who explored educational technology among 100 public high school teachers, and concluded that technology enables new possibilities of communication between the learners and their

teachers without time or space restrictions. Technology enables learners to communicate with their teachers even outside of the school environment, thus continuing the learning process.
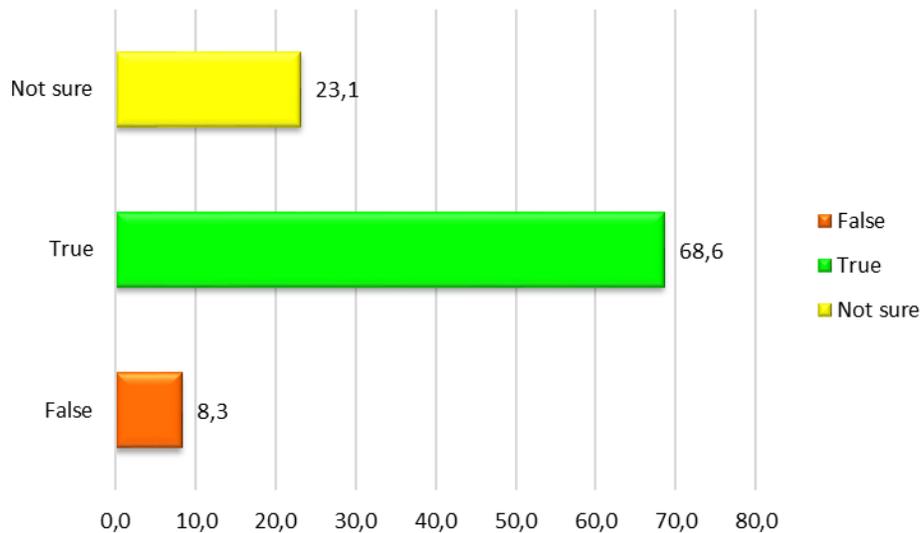
Figure 20: The effect of ICT on the syllabus

In response to the question that the use of ICT would help to cover the syllabus on time and provide sufficient time for revision, the results as illustrated in Figure 20 reveal that 68.6% of the respondents are of the view that ICT can help the teachers to cover a vast amount of scope in a short period of time, which will help the teachers to cover their scope on time and have enough time to revise certain areas. Whereas, 8.3% of the respondents felt that ICT would be rather time-consuming, and the remaining 23.1% indicated "not sure". It can, therefore, be concluded that teachers are expected to cover a certain amount of work in a given time, and ICT can help them to achieve this. This finding, however, contradicts the findings of the study conducted by Dzansi & Amedzo (2014:346), who found that most schools in the country with ICT access are not using those facilities due to

skills deficiency. Most of the teachers who lack the know-how of technology have a perception that their use of ICT in the classroom would be time-consuming.

5.1.4 Barriers to The Use ICT in Education

The following section pertains results on the challenging factors that affect the effective use of ICT in a rural classroom. The results are as follows:
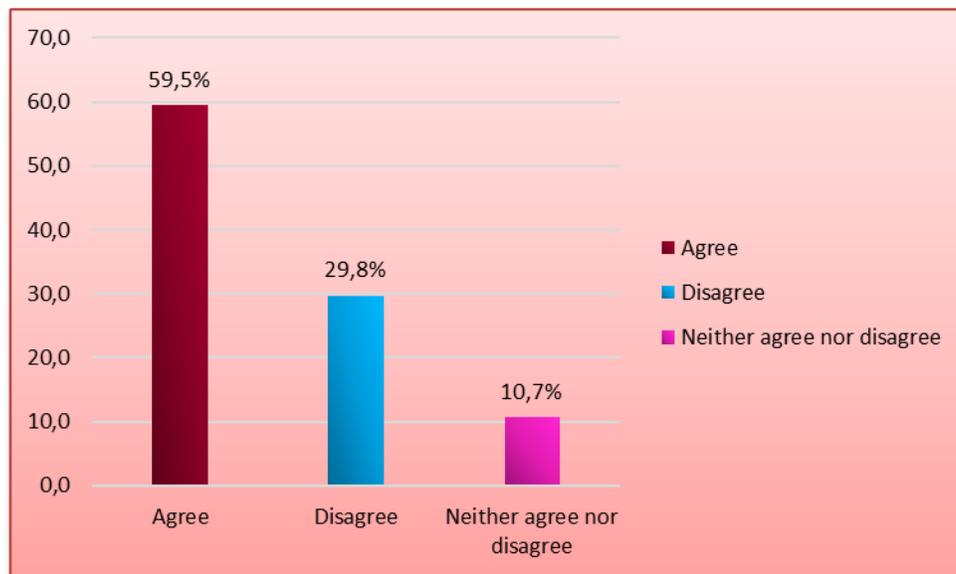
Figure 21: Skills competency

The respondents were asked whether the lack of computer skills is a factor that hinders their use of ICT for teaching. The results show that the majority of the respondents (59.5%) indicated that their inadequate ICT skills is a big challenge that they face with using ICT, followed by 29.8% who disagreed that the lack of skills is a challenge that affects their use of ICT, and the remaining 10.7% neither agree nor disagree that skills efficiency influence their ICT application in their classroom practice. From the results presented in Figure 21, a conclusion can be drawn that skills deficiency is one of the key barriers to the effective use of ICT for instruction delivery. This finding is in consensus to the findings of the study

conducted by Halili & Sulaiman (2018) and Dzansi & Amedzo (2014) who both, in separate studies assessed the factors that obstruct the use of ICT in rural schools and found that teachers in most rural schools are ICT incapable. As a result, they find it challenging to teach using ICT, to learners who are not much exposed to ICT, thus, they refrain from using ICT in their practice.

Furthermore, skills deficiency as a barrier to the use of ICT for classroom instruction was strongly emphasized in the open- ended question where it was established that, teachers fully embrace the use of ICT in the classroom, given the positive impact of ICT in the enhancement of teaching and learning experiences. However, the lack of ICT skills among most teachers is a challenge that limits their use of ICT. One respondent noted:

"We do have a computer lab, without Internet though, but it is used as an office of one of the teachers because we do not really use it, I have never used a computer before. We need training on how to use these computers."

This is consistent with Tire & Mlitwa (2015:151) who found that in cases where the facilities are availed in schools, these facilities go unused due to the lack of skills. This, therefore, confirms that the distribution of computers is meaningless without proper skills training of the use of the facilities.
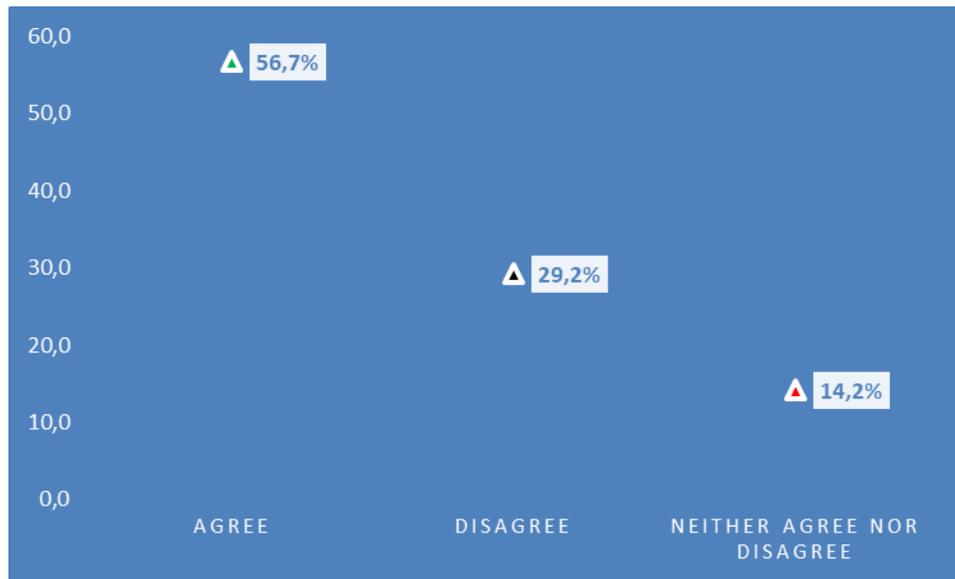
Figure 22: Skills to integrate ICT into the curriculum

In trying to understand whether the lack of skills to integrate ICT into the curriculum could be a factor contributing to the low usage of ICT among teachers, the results illustrated in Figure 22 show that more than half of the respondents (57.7%) affirmed that the deficiency of skills to integrate ICT into the curriculum is also a challenge that has an effect on their use of ICT in the classroom. 28.9% of the respondents indicated that skills to integrate ICT in their practice is not a problem for them, and the remaining 14% indicated "neither agree nor disagree". From the results illustrated above, it can be concluded that teachers lack the know-how to help them use ICT effectively in their classroom practices. This finding is buttressed by Loveless & Williamson (2013:5) who noted that the collaboration of technology and learning requires relevant skills. Buabeng-Andoh (2015:308) affirms that the lack of skills to blend ICT into classroom practice, is a key barrier among most secondary school teachers. Other studies evaluated teachers' ICT skills for classroom use and found that skills to integrate technology into teaching practice also plays a significant role in technology acceptance among teachers (Alharbi & Drew, 2014; Schoonenboom, 2014; Fathema *et al.,* 2015).
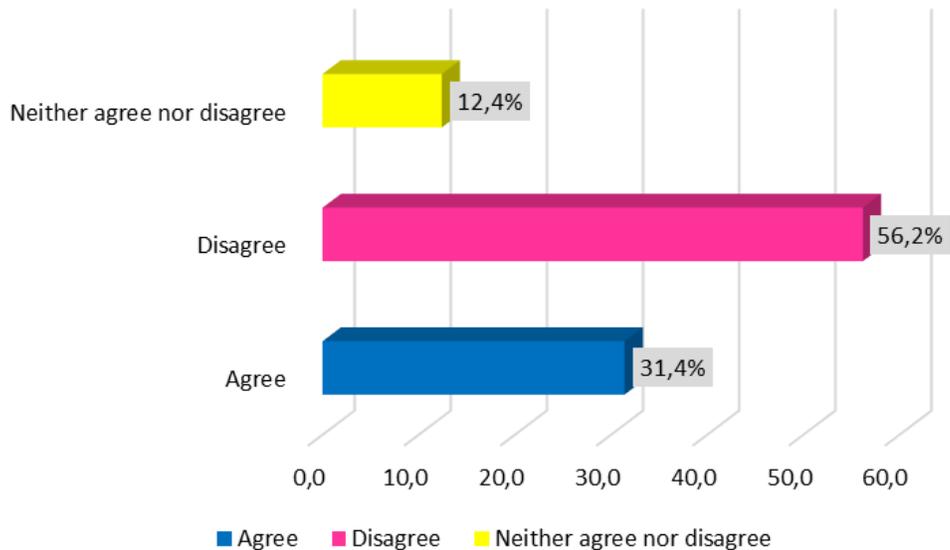
Figure 23: ICT interests

Figure 23 illustrates the influence of ICT interest, in general, in the use of ICT for teaching. The results reveal that a total of 68 (56.2%) of respondents indicated that their use of ICT for professional practice is not informed by their attitudes and beliefs towards ICT, while 31.4% agreed that the lack of interest in ICT is the reason for their low use ICT in the classroom, and 12.4% of the respondents neither agree nor disagree. It can, therefore, be concluded that the lack of interest in ICT is not a strong determining factor of the use of ICT for teaching. This finding, however, contradicts with Jeong & Kim (2017:508). In their study, Jeong & Kim (2017) assessed the acceptance of technology by teachers and found that self-efficacy is a silent factor of the acceptance of technology. In other words, there is a significant relationship between ICT skills and the intention to use, which also influenced perceived usefulness.
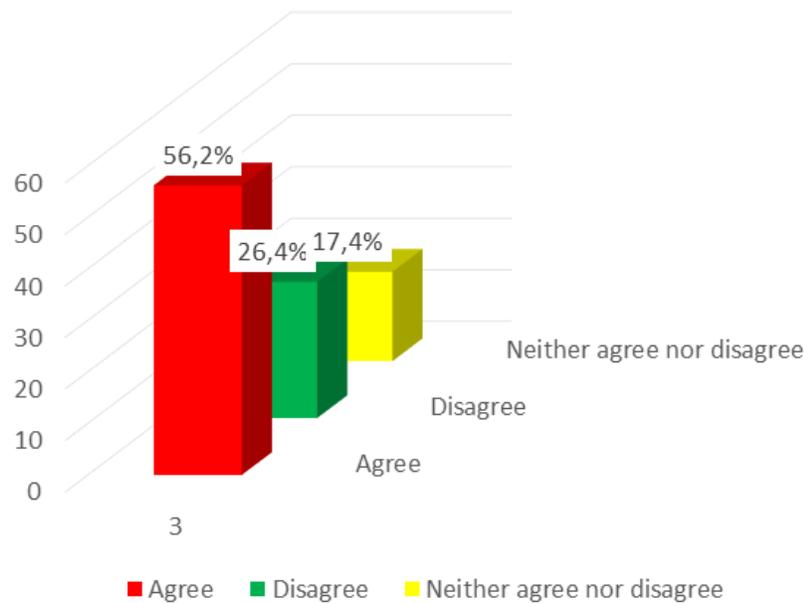
Figure 24: ICT as a priority

In response to whether the use of ICT for instruction delivery is prioritized in rural schools, the results show that most respondents (56.2%) indicated that one of the challenges they face with the use of ICT in school is that the use of ICT is not encouraged in their schools. 26.4% disagreed that the use of ICT in their schools is not given importance, and the other 17.4% indicated "neither agree nor disagree". The results as illustrated in Figure 24 conclude that the use of ICT in most rural schools is not prioritized, which can also be one of the factors affecting the effective use of ICT for teaching and learning. This concludes that encouraging the use of ICT in schools has an impact on the effective use of ICT for classroom instruction. This finding is supported by Ouma *et al.* (2013:108) who also assessed eLearning readiness in secondary schools, and concluded that the effective ICT integration in schools is dependent on giving priority to ICT. In addition, Mutua & Ng (2016) evaluated the school's readiness for ICT implementation and also found a significant relationship between the school environment and the desire to integrate. This suggests that school priorities are also influenced by the facilitating conditions of the

school. That is, schools operating under harsh conditions with poor infrastructure are most like to least prioritize ICT because of other important needs they lack.
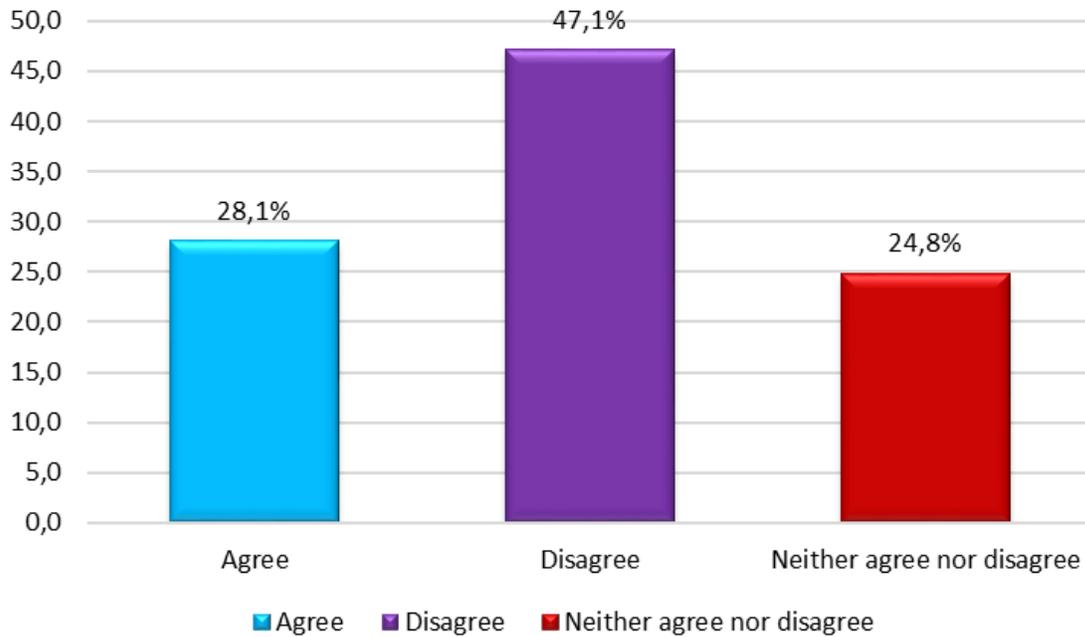
Figure 25: Maintenance of the facilities as a barrier

In seeking to understand whether the poor maintenance of the school facilities is a challenging factor that hampers the use of ICT for teaching in schools, the results as illustrated in Figure 25 show that 47.1% of the respondents disagree that the maintenance of the school computer is a challenge affecting the use of ICT for teaching in their schools. While 28.1% agree that updating computer software and maintaining the computers is a challenge in their schools, 24.8% of the respondents neither agree nor disagree. From the findings as presented in Figure 25, a conclusion can be drawn that there could be other barriers underpinned by updating and maintaining computers. This can be confirmed in the following results (*Figure 26*). That is, the issue of outdated computer software would only

be applicable to the schools which are equipped with ICT facilities. This finding is consistent with Tire & Mlitwa (2015:150) who found that most rural schools are not equipped with ICT facilities to support the teaching and learning process. In cases where a rural school is furnished with the facility, mostly through donations, teachers indicated that they still face challenges that include computers not maintained and this results in the underutilization of ICT in schools (Dzansi & Amedzo, 2014:347).
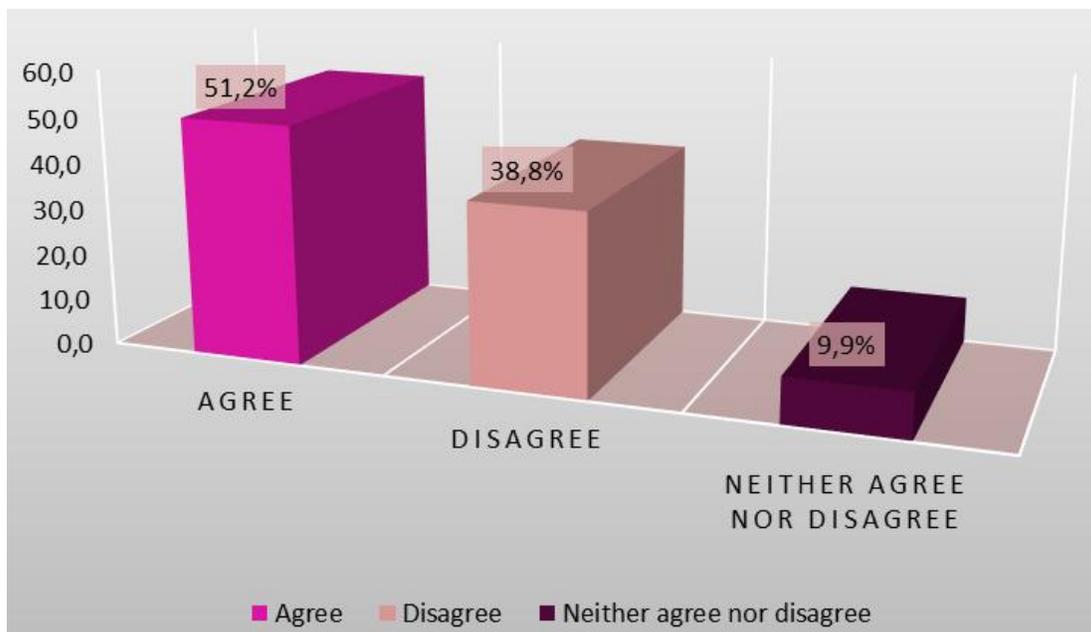
Figure 26: Lack of infrastructure as a barrier

The respondents were asked whether their challenges to the effective use of ICT include the lack of facilities in the schools. The results as presented in Figure 26 reveal that more than half (51.2%) of the respondents indicated that their schools lack the facilities to support the use of ICT for teaching, followed by 38.8% who disagreed that their schools do not have the facilities, and a minority of 9.9% neither agree nor disagree that the lack ICT resource is a factor affecting the effective use of ICT for instruction delivery. This,

therefore, suggest that there is an outcry in the availability of ICT resources to support teaching and learning in most rural secondary schools. In support of these findings is Adu (2016:1737), who conducted an analogous study in Eastern Cape and found that one of the key barriers to the effective use of ICT in education is the lack of ICT infrastructure in most disadvantaged schools. Jamil *et al.* (2016:1084) also investigated the extrinsic and intrinsic barriers to the use of ICT for teaching and found that poor infrastructure is one of the major barriers to the effective use of ICT in schools. Tire & Mlitwa (2015:152) add that most rural schools in the country lack necessary ICT resources to support teaching and learning activities.

Furthermore, concerns with regards to the lack of ICT resources as a barrier to the use were also supported by the qualitative finding. This finding revealed that in some cases the resources are availed in the schools, however, these resources are not enough. Teachers noted that the use of the available resources is not effective because there are not /enough resources. One teacher wrote:

> *"Another area of concern is that facilities like laptops are not enough for all learners since we only have 22 laptops to cater for more than 500 learners."*

In addition, rural teachers view the lack of resources in their schools as a gap that differentiates them from other schools.

> *"It has been proven that schools that invest in ICT have impeccable academic performance e.g. Gauteng and Limpopo."*

This statement suggests that teachers in rural schools feel disconnected to development enjoyed by other schools in the country, which contributes to the unsatisfactory learner performance in most rural schools.

5.2 Reliability Analysis

The Chi-square test was used to determine the association between gender and the lack of skills among rural secondary school teachers. The relationship was tested based on the following:

Research question

Is there a relationship between gender and ICT skills?

Hypothesis

There is no association between gender and ICT skills among rural secondary school teachers.

Table 11: Relationship between Gender and ICT skills

Case Processing Summary

| | Cases | | | | | |
| | Valid | | Missing | | Total | |
	N	Percent	N	Percent	N	Percent
Lack of computer skills * Gender	121	100.0%	0	0.0%	121	100.0%

Table 11 reveals that there are 121 respondents who participated in this study and there is no missing data. Thus, the valid number of cases (valid N) is 121.

Table 12: Gender and skills cross tabulation

Lack of computer skills * Gender Cross tabulation

			Male	Female	Total
				Gender	
Lack of computer skills	Agree	Count	29	43	72
		Expected Count	30.3	41.7	72.0
		% within Gender	56.9%	61.4%	59.5%
		% of Total	24.0%	35.5%	59.5%
	Disagree	Count	16	20	36
		Expected Count	15.2	20.8	36.0
		% within Gender	31.4%	28.6%	29.8%
		% of Total	13.2%	16.5%	29.8%
	Neither agree nor disagree	Count	6	7	13
		Expected Count	5.5	7.5	13.0
		% within Gender	11.8%	10.0%	10.7%
		% of Total	5.0%	5.8%	10.7%
Total		Count	51	70	121
		Expected Count	51.0	70.0	121.0
		% within Gender	100.0%	100.0%	100.0%
		% of Total	42.1%	57.9%	100.0%

Table 12 shows that out of the total percent of 59.5 respondents who indicate that the lack of computer skills is a barrier to their use of ICT in the classroom, the majority of 35.5% were female respondents and 24.0% were male respondents.

Table 13: Chi-Square test

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.267[a]	2	.875
Likelihood Ratio	.266	2	.875
Linear-by-Linear Association	.252	1	.615
N of Valid Cases	121		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.48.

Table 13 reveals that the Pearson Chi-Square value is .267, with 2 degrees of freedom and the significance of .875. The significance level is less than .05. Therefore, the two variables are insignificant. This suggest that there is no relationship between gender and ICT competencies among rural secondary school teachers. This result is consistent with Tondeur *et al.* (2018:35) who also found no correlation between gender and ICT skills among teachers.

5.3 Summary

Both quantitative and qualitative findings of this stud, as presented above, interrogated teachers' views on the use of ICT for classroom instruction. While the numbers (quantitative) show that ICT integration in rural secondary schools is much needed, the qualitative aspect of this study avowed that teachers feel that the use of ICT in the classroom has the potential to enhance teaching and learning outcomes. Thus, this concludes that ICT usage in the classroom can be maximized for the good of the classroom experiences. This will not only contribute to the national strategies of the country, but will also assist in meeting the demands global change which has brought about industrial revolution. Gleason (2018:15) affirms that the world is in an automation era, therefore, academic institutions need to respond to these changes by technology exploitation.

On the other hand, the study revealed that not schools have the capacity to deliver instruction using ICT. The study revealed that most rural schools' leg behind in the use of technology due to barriers that include skills deficiency and the lack of resources to support ICT pedagogies.

5.4 Conclusion

This chapter has presented the analysis and interpretation of the data collected from the respondents using the questionnaires. One major finding revealed in this study is the lack of ICT skills among teachers as a factor affecting the use of ICT in the classroom. The findings of this study were presented using 30 illustrations (tables and graphs), and a brief overview of the respondents' responses. The next chapter provides the final conclusions and recommendations of the entire study.

C h a p t e r   6

CONCLUSIONS AND RECOMMENDATIONS

6. Introduction

The previous chapter presented the findings and the discussion of the results. This chapter is the final chapter that summarizes the findings of the study. Furthermore, the chapter discusses final conclusions and recommendations for future research in the enhancement of rural secondary school classroom experiences through digitisation.

6.1 The Problem

The current study was set out to investigate teachers' perceptions on the use of ICT for classroom instruction in rural secondary schools, in the King Cetshwayo District.

6.2 Conclusions

At this juncture, the researcher relates the findings of the study with objectives in order to check whether the research questions were answered and further proposes recommendations based on the findings. The primary aim of the study was to investigate how the use of Innovative Communication Protocols in the classroom can assist teachers in rural secondary schools, with the following objective, as stated in the orientation of this study:

i. To examine the extent of communication technologies being used among teachers in rural secondary schools.
ii. To determine the teachers' perceptions towards the use of new communication protocols for instruction within rural classrooms.
iii. To investigate factors affecting the effective use of new communication protocols in rural secondary schools.

To examine the extent of communication technologies being used amongst teachers in rural secondary schools

This objective sought to examine the level of ICT usage among teachers in rural secondary schools. The major finding was that most of the rural schools in the King Cestwayo District are equipped with either computers or the Internet. However, it is unclear if these facilities are available for teacher use or are they being used for other duties such as administrative duties. Furthermore, it is worth noting that while the findings show that most rural schools have ICT facilities, the extent of the use of ICT remains low due to the lack of teacher development in ICT. Thus, Khatete *et al.* (2015:373) sustain that the provision of ICT resources in schools is meaningless without proper teacher training for the use of the facilities. Evidence of this is the teachers' inability to use ICT effectively for teaching purposes as proven in this study. Mutua and Ng (2016) are consistent with the idea that the extent of the use of ICT in schools is limited by skills deficiency. Thus, Duma & Buthelezi (2016:58) highlight the need for teacher development training to prepare them for the new instruction approach.

To determine the teachers' perceptions towards the use of new communication protocols for instruction within rural classrooms

The second objective of the study was set out to determine teachers' attitudes and beliefs on the use of new communication protocols in a rural classroom. The findings reveal that even though the level of the use of ICT is restricted by the lack of skills, among most teachers in rural schools; teachers still show positive attitudes towards the use of ICT for classroom instruction (*see Figure 13*). This study has proved that teachers strongly believe that ICT has potential to enhance classroom experience in a number of ways. Subhash & Cudney (2018:204) found that teachers believe that the use of ICT in the classroom helps in promoting the learning culture among learners. That is, teachers evaluate the usefulness of ICT in the classroom based on the impact that it would have on the learner. As a result, teachers find ICT relevant to the learners in a manner that learners relate better to ICT than

to a teacher in front of them with a chalk and board. Teachers, therefore, see the use of ICT fitting for instruction delivery. They believe that learners can benefit from the information availed by technology which can contribute to their performance (*see Figure 15*). This finding was consistent with (Livingstone, 2012; Wirzberger *et al.*, 2016). Figure 16 shows findings on the impact of the use of ICT to the learners, and this study confirms that teachers believe that the use of ICT in the classroom would have a positive effect on learner participation by encouraging interactive participation. Finn *et al.* (2018:108) reported similar findings that teachers believe that ICT enhances the classroom experiences with improved feedback which positively enhances the teaching and learning process (Koivisto & Hamari, 2014; Adukaite *et al.*, 2017; Lam *et al.*, 2018). It can, therefore, be confirmed that the second objective of this study, to measure teachers' perceptions, was met.

However, with all the given advantages of the use of ICT in the classroom, the study also noted that teachers are concerned with other negative effects associated with the use of ICT for learning. With regard to the writing skills, the study shows that most teachers are very concerned that ICT would have a negative effect on learners' writing skills. That is, while ICT strengthens other aspects of learning, there remains a loophole (*see Figure 14*).

To investigate factors affecting the effective use of new communication protocols in rural secondary schools

This objective was intended to investigate the factors that hinder the effective use of ICT in the classroom. The study found that the lack of computer skills is a prominent factor that impends the use of ICT among teachers. The results presented in this study conclude that teachers are willing to embrace technology and even find it useful for their professional practice. However, teachers indicated that they are faced with a number of challenges that affect their use of technology in the classroom. The lack of computer skills was the most noted barrier to the use of ICT for teaching and learning (*see Figure 21*). Previous studies have noted this barrier as the key barrier to the use of technology among teachers (Kafyulilo *et al.,* 2016; Asensio-Pérez *et al.*, 2017). The study further revealed that the lack of skills

to integrate ICT into the curriculum is also a challenge (*see Figure 22*). It was revealed that although teachers believe that ICT can assist them in their practice they are, however, incapacitated by their inadequate skills to use ICT. While certain teachers have computer skills to some extent, others who lack basic ICT skills indicated that it is not possible for them to have skills to integrate ICT into the curriculum when they still lack the basics. This suggests that there is a difference between the use of ICT in general and blending ICT with education. Thus exists the importance of training teachers for the use of ICT specifically for teaching (Sipilä, 2014:238).

Redempta & Elizabeth (2012:146) found that the level of school readiness to integrate ICT into the curriculum is also a factor that affects the use of ICT in schools (Tire & Mlitwa, 2015; Baydas & Goktas, 2016). The findings of this study are consistent with the notion that the preparedness of the school to integrate ICT is a determining factor of the effective use of ICT in schools. That is, if the school lacks the basic needs such as the infrastructure, encouraging the use of ICT in such schools is less important than the availability of infrastructure. In some rural schools, the availability of electricity is still a major barrier that has a direct effect on the development of a school (Khatete *et al.*, 2015; Tire & Mlitwa, 2015). In this study, it was revealed that most rural schools lack infrastructure to support technology-enhanced pedagogies (*see Figure 26*), as a result, the use of ICT in such schools is of less priority (*see Figure 24*).

6.3 Recommendations

Based on the findings of this study, the following recommendations are made:

1. With reference to the 4IR, that most of our rural communities have missed, while on the other hand technological progressions is dynamic and wait for no man; we need to find ways on how we can cope with getting ready for the Fifth Industrial Revolution. That is, strategies on how rural school learners can be prepared for the Fifth Industrial Revolution in order to be relevant for the future is another area of concern.

2. Future research needs to focus on how rural schools can use blended learning to catch-up with the Fourth Industrial Revolution, taking into consideration that Eskom debts have resulted in power cuts that have progressively became very critical. Alternative sources of energy such as biogas and solar energy should, therefore, be considered in the provision of ICT resources in rural schools experiencing the unavailability and inconsistency of power.

3. The integration of the use of ICT in schools should be in accordance with the needs of the school. Basic needs, such as infrastructure should be met first in order to ensure the effective use of ICT for the enhancement of classroom experiences.

4. As revealed in the findings that most schools are equipped with ICT facilities, the provision of the resources should be supported by skills development among teachers.

5. The first step in developing teachers with ICT skills should focus on pre-service teachers. Institutions of higher learning should play a role in enforcing ICT literacy as part of the pre-service teacher's training course. In so doing, these teachers will enter the field of practice with necessary ICT skills for teaching practices. On the other hand, teachers that are already practising should be developed in a form of workshops, where the district has to play a role in ensuring the execution of these workshops in schools.

6. The government has a leading role to play in the effective use of ICT in rural schools by ensuring that the facilities are well maintained, and software are updated. This can be achieved if the government could appeal to other private sectors, such as Telkom to assist in regular maintenance of the facilities in schools.

7. Based on the average number of learners in a single class, the available resources are insufficient to support learning. Therefore, the government should bring on board other sectors to invest in the future of our country through computer donations to the needy schools for enhancement of the quality of education. Meanwhile, the schools can make provision for allowing the learners to use their personal devices (smartphones) for learning purpose on the school premises. This will the call for the Department of Basic Education to furnish the schools with Internet access so that learners can connect with their devices strictly for learning purposes.

8. The school principals must encourage the use of ICT in schools through internal seminars for teachers to exchange ideas on the use of ICT for teaching. This may be helpful in the case of the middle-aged group of teachers who frequent the use of ICT for other purposes to try and bring older school teachers on board with the use of ICT.

9. It is also recommended that the teachers familiarise themselves with innovative technologies to realise its usefulness, which will contribute to their intention to use ICT in their teaching practices.

REFERENCES

Adams, C. M., Lo, J. C., Goodell, A. and Nachtigal, S. (2017) 'Shifting Pedagogy in an AP US Government & Politics Classroom: A DBIR Exploration of Teacher Growth', *Teaching and Teacher Education*. Elsevier Ltd, 64, pp. 79–92. doi: 10.1016/j.tate.2017.01.011.

Admiraal, W., Louws, M., Lockhorst, D., Paas, T., Buynsters, M., Cviko, A., Janssen, C., De Jonge, M., Nouwens, S., Post, L., Van der Ven, F. and Kester, L. (2017) 'Teachers in School-Based Technology Innovations: A Typology of their Beliefs on Teaching and Technology', *Computers and Education*. Elsevier Ltd, 114, pp. 57–68. doi: 10.1016/j.compedu.2017.06.013.

Adu, E. O. (2016) 'E-Learning Facilities Usage Assessment by Economics and Management Science (EMS) Teachers in Eastern Cape Province, South Africa', *EdMedia*, pp. 1732–1738.

Adukaite, A., Van Zyl, I., Er, S. and Cantoni (2017) 'Teacher Perceptions on the Use of Digital Gamified Learning in Tourism Education: The case of South African Secondary Schools', *Computers & Education*, 111, pp. 172–190. doi: 10.1016/j.compedu.2017.04.008.

Akçayir, M., Dündar, H. and Akçayir, G. (2016) 'What Makes You a Digital Native? Is it Enough to be Born After 1980?', *Computers in Human Behavior*, 60, pp. 435–440. doi: 10.1016/j.chb.2016.02.089.

Akinyemi, F. O. (2016) 'Technology use in Rwandan Secondary Schools: An Assessment of Teachers Attitudes Towards Geographic Information Systems (GIS)', *International Research in Geographical and Environmental Education*. Taylor & Francis, 25(1), pp. 20–35. doi: 10.1080/10382046.2015.1106848.

Al-Adwan, A., Al-Adwan, A. and Smedley, J. (2013) 'Exploring Students Acceptance of E-Learning Using Technology Acceptance Model in Jordanian Universities', *International Journal of Education and Development using Information and Communication Technology*, 9(2), pp. 4–18. Available at: http://ijedict.dec.uwi.edu/viewarticle.php?id=1617.

Al-eidan, E. A. (2017) 'Technology In The Classroom: Tools, Advantages, Barriers, Attitudes and Resources Limitation', *British Journal of Education*, 5(1), pp. 38–53.

Al-gahtani, S. S. (2016) 'Empirical Investigation of E-learning Acceptance and Assimilation : A Structural Equation Model', *Applied Computing and Informatics*. King Saud University, 12, pp. 27–50. doi: 10.1016/j.aci.2014.09.001.

Al-rahmi, W. M. and Zeki, A. M. (2017) 'A Model of Using Social Media for Collaborative

Learning to Enhance Learners' Performance on Learning', *Journal of King Saud University - Computer and Information Sciences*. The Authors, pp. 1–10. doi: 10.1016/j.jksuci.2016.09.002.

Alharbi, S. and Drew, S. (2014) 'Using the Technology Acceptance Model in Understanding Academics' Behavioural Intention to Use Learning Management Systems', *International Journal of Advanced Computer Science and Applications*, 5(1), pp. 143–155. doi: 10.14569/IJACSA.2014.050120.

Alt, D. (2018) 'Science Teachers' Conceptions of Teaching and Learning, ICT Efficacy, ICT Professional Development and ICT Practices Enacted in their Classrooms', *Teaching and Teacher Education*. Elsevier Ltd, 73, pp. 141–150. doi: 10.1016/j.tate.2018.03.020.

Alwagait, E., Shahzad, B. and Alim, S. (2015) 'Impact of Social Media Usage on Students Academic Performance in Saudi Arabia', *Computers in Human Behavior*. Elsevier Ltd, 51, pp. 1092–1097. doi: 10.1016/j.chb.2014.09.028.

Alwahaishi, S. and Snášel, V. (2013) 'Consumers' Acceptance and Use of Information and Communications Technology: A UTAUT and Flow Based Theoretical Model', *Journal of Technology Management and Innovation*, 8(2), pp. 61–73. doi: 10.4067/S0718-27242013000200005.

Amin, M., Rezaei, S. and Abolghasemi, M. (2014) 'User Satisfaction With Mobile Websites: the Impact of Perceived Usefulness (PU), Perceived Ease of Use (PEOU) and Trust', *Nankai Business Review International*, 5(3), pp. 258–274. doi: 10.1108/NBRI-01-2014-0005.

An, Y. and Reigeluth, C. (2011) 'Creating Technology-Enhanced, Learner-Centered Classrooms: K–12 Teachers' Beliefs, Perceptions, Barriers, and Support Needs', *Journal of Digital Learning in Teacher Education*, 28(2), pp. 54–62. doi: 10.1080/21532974.2011.10784681.

Andoh-Baidoo, F. K., Osatuyi, B. and Kunene, K. N. (2014) 'ICT Capacity as the Investment and Use of ICT: Exploring its Antecedents in Africa', *Information Technology for Development ISSN:*, 20(1), p. 44=59. doi: 10.1080/02681102.2013.804399.

Asensio-Pérez, J. I., Dimitriadis, Y., Pozzi, F., Hernández-Leo, D., Priieto, L. P., Persico, D. and Villagra-Sobrino, S. L. (2017) 'Towards Teaching as Design: Exploring the Interplay Between Full-Lifecycle Learning Design Tooling and Teacher Professional Development', *Computers & Education*, 114, pp. 92–116. doi: https://doi.org/10.1016/j.compedu.2017.06.011.

Attuquayefio, S. N. and Addo, H. (2014) 'Using the UTAUT Model to Analyze Students '

ICT Adoption', *International Journal of Education and Development using Information and Communication Technology*, 10(3), pp. 75–86. doi: 10.1016/j.amjsurg.2007.10.027.

Autor, D. H. and Dorn, D. (2013) 'The Growth of Low-Skill Service Jobs and the Polarization of the US Labor Market', *American Economic Review*, 103(5), pp. 1553–1597. doi: 10. 1257/aer. 103.5. 1553.

Avery, L. M. (2013) 'Rural Science Education: Valuing Local Knowledge', *Theory into Practice*, 52(1), pp. 28–35. doi: 10.1080/07351690.2013.743769.

Badia, A., Meneses, J., Sigales, C. and Fabregues (2014) 'Factors Affecting School Teachers' Perceptions of the Instructional Benefits of Digital Technology', *Procedia - Social and Behavioral Sciences*. Elsevier B.V., 141, pp. 357–362. doi: 10.1016/j.sbspro.2014.05.063.

Bai, Y., Mo, D., Zhang, L., Boswell, M. and Rozelle, S (2016) 'The Impact of Integrating ICT With Teaching: Evidence from a Randomized Controlled Trial in Rural Schools in China', *Computers and Education*, 96, pp. 1–14. doi: 10.1016/j.compedu.2016.02.005.

Baturay, M. H., Gökçearslan, Ş. and Ke, F. (2017) 'The Relationship Among Pre-Service Teachers' Computer Competence, Attitude Towards Computer-Assisted Education, and Intention of Technology Acceptance', *International Journal of Technology Enhanced Learning*, 9(1), pp. 1–13. doi: 10.1504/IJTEL.2017.084084.

Baydas, O. and Goktas, Y. (2016) 'Influential Factors on Preservice Teachers' Intentions to Use ICT in Future Lessons', *Computers in Human Behavior*. Elsevier Ltd, 56, pp. 170–178. doi: 10.1016/j.chb.2015.11.030.

Beauchamp, G. and Kennewell, S. (2010) 'Interactivity in the Classroom and its Impact on Learning', *Computers and Education*. Elsevier Ltd, 54, pp. 759–766. doi: 10.1016/j.compedu.2009.09.033.

Bellini, C. G. P., Filho, M. M. I., De Moura Junior, P. J. and Pereira, R. (2016) 'Self-Efficacy and Anxiety of Digital Natives in Face of Compulsory Computer-Mediated Tasks: A Study About Digital Capabilities and Limitations', *Computers in Human Behavior*, 59, pp. 49–57. doi: 10.1016/j.chb.2016.01.015.

Biswas, A. and Zhang, Y. (2018) 'Sampling Designs for Validating Digital Soil Maps: A Review', *Pedosphere*. Soil Science Society of China, 28(1), pp. 1–15. doi: 10.1016/S1002-0160(18)60001-3.

Blackwell, C. K., Lauricella, A. R., Wartella, E., Robb, M. and Schomburg, R. (2013)

'Adoption and Use of Technology in Early Education: The Interplay of Extrinsic Barriers and Teacher Attitudes', *Computers and Education*. Elsevier Ltd, 69, pp. 310–319. doi: 10.1016/j.compedu.2013.07.024.

Blanche, M. T., Kevin, D. and Painter, D. (2006) *Research in Practice*. 2nd edn. Cape Town: University of Cape Town Press.

Bol, T. (2015) 'Has Education Become More Positional? Educational Expansion and Labour Market Outcomes, 1985-2007', *Acta Sociologica*, 52(2), pp. 105–120. doi: 10.1177/0001699315570918.

Boynton, P. M. (2004) 'Selecting, Designing, and Developing Your Questionnaire', *Bmj*, 328(7451), pp. 1312–1315. doi: 10.1136/bmj.328.7451.1312.

Bozalek, V., Gachago, D., Alexander, L., Watters, K., Wood, D., Ivala, E. and Herrington, J. (2013) 'The Use of Emerging Technologies for Authentic Learning: A South African Study in Higher Education', *British Journal of Educational Technology*, 44(4), pp. 629–638. doi: 10.1111/bjet.12046.

Bray, A. and Tangney, B. (2017) 'Technology Usage in Mathematics Education Research – A Systematic Review of Recent Trends', *Computers and Education*. Elsevier Ltd, 114, pp. 255–273. doi: 10.1016/j.compedu.2017.07.004.

Brink, H., Van der Walt, C. and Van Rensburg, G. (2012) *Fundamentals of Research Methodology for Healthcare Professionals.* 3rd edn. Cape Town: Juta.

Brown, C. and Czerniewicz, L. (2010) 'Debunking the "Digital Native": Beyond Digital Apartheid, Towards Digital Democracy', *Journal of Computer Assisted Learning*, 26, pp. 357–369. doi: 10.1111/j.1365-2729.2010.00369.x.

Brown, J. P. (2017) 'Teachers' Perspectives of Changes in their Practice During a Technology in Mathematics Education Research Project', *Teaching and Teacher Education*. Elsevier Ltd, 64, pp. 52–65. doi: 10.1016/j.tate.2017.01.022.

Brown, M., Dehoney, J. and Millichap, N. (2015) 'The Next Generation Digital Learning Environment', *EDUCAUSE*, pp. 1–11.

Brynard, D. J., Hanekom, S. X. and Brynard, P. A. (2014) *Introduction to Research*. 3rd edn. Pretoria: Van Schaik.

Brynjolfsson, E. and Mcafee, A. (2012) 'Race Against The Machine: How The Digital Revolution Is Accelerating Innovation, Driving Productivity, and Irreversibly Transforming

Employment and The Economy'.

Buabeng-Andoh, C. (2015) 'ICT Usage in Ghanaian Secondary Schools: Teachers' Perspectives', *International Journal of Information and Learning Technology*, 32(5), pp. 300–312. doi: 10.1108/IJILT-09-2015-0022.

Burnett, C. (2010) 'Technology and Literacy in Early Childhood Educational Settings: A Review of Research', *Journal of early childhood literacy*, 10(3), pp. 1–18. doi: 10.1177/1468798410372154.

Cacciamani, S., Villani, D., Bonanomi, A., Carissoli, C., Olivari, M. G., Morganti, L., Riva, Giuseppe and Confalonieri, E. (2018) 'Factors Affecting Students' Acceptance of Tablet PCs: A Study in Italian High Schools', *Journal of Research on Technology in Education*, 50(2), pp. 120–133. doi: 10.1080/15391523.2017.1409672.

Caird, S. and Lane, A. (2015) 'Conceptualising the Role of Information and Communication Technologies in the Design of Higher Education Teaching Models Used in the UK', *British Journal of Educational Technology*, 46(1), pp. 58–70. doi: 10.1111/bjet.12123.

Calisir, F., Gumussoy, C. A., Bayraktaroglu, A. E. and Karaali, D. (2015) 'Predicting the Intention to Use a Web-Based Learning System: Perceived Content Quality, Anxiety, Perceived System Quality, Image, and the Technology Acceptance Model', *Human Factors and Ergonomics in Manufacturing & Service Industries*, 24(5), pp. 515–531. doi: 10.1002/hfm.

Capriati, M. and Divella, M. W. (2017) 'Work Organisation, Human Capital and Innovation Strategies: New Evidence From Firm-Level Italian Data', *GLO Discussion*, 97, pp. 1–27.

Castañer, M., Camerino, O., Anguera, M.T., Jonsson, G. K., (2015) 'Paraverbal Communicative Teaching T- Patterns Using SOCIN and SOPROX Observational Systems', *Pagina*, pp. 1–17. doi: 10.1007/978-1-4939-3249-8.

Cazan, A. M., Cocorada, E. and Maican, C. I. (2016) 'Computer Anxiety and Attitudes Towards The Computer and The Internet With Romanian High-School and University Students', *Computers in Human Behavior*, 55, pp. 258–267. doi: 10.1016/j.chb.2015.09.001.

Cerezo, R., Sanchez-Santillan, M., Paule-Ruiz, M. P. and Nunez, J. Z. (2016) 'Students' LMS Interaction Patterns and their Relationship With Achievement: A case study in Higher Education', *Computers and Education*, 96, pp. 42–54. doi: 10.1016/j.compedu.2016.02.006.

Chair, C., Mdleleni, L., Moyo, M. and Mthimkhulu, S. (2017) 'Internet Use Barriers and User Strategies: South Africa Report', (May), pp. 1–19.

111

Chao-Fernandez, R., Román-García, S. and Chao-Fernandez, A. (2017) 'Analysis of the Use of ICT Through Music Interactive Games as Educational Strategy', *Procedia - Social and Behavioral Sciences*. pp. 576–580. doi: 10.1016/j.sbspro.2017.02.109.

Cheung, R. and Vogel, D. (2013) 'Predicting User Acceptance of Collaborative Technologies: An Extension of the Technology Acceptance Model for E-learning', *Computers & Education*, 63, pp. 160–175. doi: 10.1016/j.compedu.2012.12.003.

Chingona, A., Chigona, W., Kayongo, P. and Kausa, M. (2010) 'An Empirical Survey on Domestication of ICT in Schools in Disadvantaged Communities in South Africa Agnes Chigona , Wallace Chigona , Patrick Kayongo and Moses Kausa', *International Journal of Education and Development using Information and Communication Technology*, 6(2), pp. 21–32.

Cirillo, V., Pianta, M. and Nascia, L. (2018) 'Technology and Occupations in Business Cycles', *Sustainability (Switzerland)*, 10(2), pp. 1–25. doi: 10.3390/su10020463.

Conradie, D., Morris, C. and Jacobs, S. J. (2003) 'Using Information and Communication Technologies (ICTs) for Deep Rural Development in South Africa', *Communicatio*, 29, pp. 201–219. doi: 10.1080/02500160308538027.

Copriady, J. (2015) 'Self - Motivation as a Mediator for Teachers' Readiness in Applying ICT in Teaching and Learning', *Procedia - Social and Behavioral Sciences 176*. Elsevier, 176, pp. 699–708. doi: 10.1016/j.sbspro.2015.01.529.

Czerniewicz, L. and Brown, C. (2013) 'The Habitus of Digital "Strangers" in Higher Education', *British Journal of Educational Technology*, 44(1), pp. 44–53. doi: 10.1111/j.1467-8535.2012.01281.x.

Dainton, M. and Zelley, E. D (2015) *Applying Communication Theory for Professional Life: a practical introduction*. 3nd ed. California: Sage.

Davis, F. D. (1986) *A Technology Acceptance Model for Empirically Testing New End-User Information Systems: Theory and Results. Massachusetts Institute of Technology.*

Davis, F. D. (1989) 'Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology', *MIS Quarterly*, 13(3), p. 319. doi: 10.2307/249008.

De Araujo, Z., Otten, S. and Birisci, S. (2017) 'Mathematics Teachers' Motivations for, Conceptions of, and Experiences With Flipped Instruction', *Teaching and Teacher Education*. Elsevier Ltd, 62, pp. 60–70. doi: 10.1016/j.tate.2016.11.006.

Deloitte (2018) *The Fourth Industrial Revolution is Here—Are You Ready?*

Duma, M. and Buthelezi, A. (2016) 'Staff Development in Rural Schools in South Africa: Experiences of Principals in Uthungulu District', *Stud Tribes Tribals,* 14(1), pp. 54–59.

Du Toit, J. (2015) 'Teacher Training and Usage of ICT in Education', *Unesco*, (September), pp. 1–22.

Dzansi, D. Y. and Amedzo, K. (2014) 'Integrating ICT into Rural South African Schools : Possible Solutions for Challenges', *International Journal of Education and Science*, 6(2), pp. 341–348. doi: 10.1080/09751122.2014.11890145.

Eberhard, B., Podio, M., Alonso, A. P., Radovica, E., Avotina, L., Peiseniece, L., Sendon, M. C., Lozano, A. G and Sole-Pla, J. (2017) 'Smart work: The Transformation of the Labour Market Due to the Fourth Industrial Revolution (I4.0)', *International Journal of Business & Economic Sciences Applied Research*, 10(3), p. p47–66. 20p. doi: 10.25103/ijbesar.103.03.

Edmonds, W. A. and Kennedy, T. D. (2017) *An Applied Guide to Research Designs: Quantitative, Qualitative, and Mixed Methods.* 2nd edn. California: Sage Publications.

Eke, H. N. (2010) 'The Perspective of E-learning and Libraries in Africa: Challenges and Opportunities', 59(4), pp. 274–290. doi: 10.1108/00242531011038587.

Erdiaw-Kwasie, M. O. and Alam, K. (2016) 'Towards Understanding Digital Divide in Rural Partnerships and Development: A Framework and Evidence From Rural Australia', *Journal of Rural Studies journal*, 43, pp. 214–224. doi: 10.1016/j.jrurstud.2015.12.002.

Ernst, B. and Steinhauser, M. (2017) 'Top-down Control Over Feedback Processing: The Probability of Valid Feedback Affects Feedback-Related Brain Activity', *Brain and Cognition*. Elsevier, 115(April), pp. 33–40. doi: 10.1016/j.bandc.2017.03.008.

Etikan, I., Musa, S. A. and Alkassim, R. S. (2016) 'Comparison of Convenience Sampling and Purposive Sampling', *American Journal of Theoretical and Applied Statistics*, 5(1), pp. 1–4. doi: 10.11648/j.ajtas.20160501.11.

Faqih, K. M. S. (2013) 'Exploring the Influence of Perceived Risk and Internet Self-efficacy on Consumer Online Shopping Intentions : Perspective of Technology Acceptance Model', *International Management Review*, 9(1), pp. 67–78. doi: 10.1111/evo.13124.

Farmery, R. M. (2014) *The Integration and Use of ICT Across the Secondary School*. Cardiff University. Available at: http://orca.cf.ac.uk/74065/2/0725857 - Ruth Farmery final thesis.pdf [Accessed: 31 August 2018].

Fathema, N., Shannon, D. and Ross, M. (2015) 'Expanding The Technology Acceptance Model (TAM) to Examine Faculty Use of Learning Management Systems (LMSs) In Higher Education Institutions', *MERLOT Journal of Online Learning and Teaching*, 11(2), pp. 210–232. doi: 10.12720/joams.4.2.92-97.

Fidalgo-Blanco, A., Martinez-Nunez, M., Borras-Gene, O. and Sanchez-Medina, J. J. (2017) 'Micro Flip Teaching – An Innovative Model to Promote the Active Involvement of Students', *Computers in Human Behavior*, 72, pp. 713–723. doi: 10.1016/j.chb.2016.07.060.

Finn, B., Thomas, R. and Rawson, K. A. (2018) 'Learning More from Feedback: Elaborating Feedback With Examples Enhances Concept Learning', *Learning and Instruction*. Elsevier Ltd, 54, pp. 104–113. doi: 10.1016/j.learninstruc.2017.08.007.

Freeman, R. and Schettkat, R. (2001) 'Marketization of Production and the US – Europe Employment Gap', *Blackwell Publishers*, pp. 647–670.

Frey, C. B. and Osborne, M. A. (2013) 'The Future of Employment: How Susceptible are Jobs to Computerisation?', pp. 1–72.

Fuchs, C. and Horak, E. (2008) 'Africa and the Digital Divide', *Telematics and Informatics*, 25, pp. 99–116. doi: 10.1016/j.tele.2006.06.004.

Fuglseth, A. M. and Sørebø, Ø. (2014) 'The Effects of Technostress Within the Context of Employee Use of ICT', *Computers in Human Behavior*. Elsevier Ltd, 40, pp. 161–170. doi: 10.1016/j.chb.2014.07.040.

Gallego, M. D., Bueno, S. and Noyes, J. (2016) 'Second Life Adoption in Education: A Motivational Model Based on Uses and Gratifications theory', *Computers & Education*. Elsevier Ltd, 100, pp. 81–93. doi: 10.1016/j.compedu.2016.05.001.

Garland, K. V (2010) 'E-Learning vs. Classroom Instruction in Infection Control in a Dental Hygiene Program', *Journal of Dental Education*, pp. 637–643.

Gaudreau, P., Miranda, D. and Gareau, A. (2014) 'Canadian University Students in Wireless Classrooms: What Do they Do on their Laptops and Does it Really Matter?', *Computers and Education*. Elsevier Ltd, 70, pp. 245–255. doi: 10.1016/j.compedu.2013.08.019.

Genlott, A. A. and Grönlund, Å. (2016) 'Closing the Gaps - Improving Literacy and Mathematics by ICT-Enhanced Collaboration', *Computers and Education*, 99, pp. 68–80. doi: 10.1016/j.compedu.2016.04.004.

Gibson, P. A., Stringer, K., Cotton, S. R., Simoni, Z., O'Neal, L. J. and Howell-Moroney, M.

(2014) 'Changing Teachers, Changing Students? The Impact of a Teacher-Focused Intervention on Students' Computer Usage, Attitudes , and Anxiety', *Computers & Education*. Elsevier Ltd, 71, pp. 165–174. doi: 10.1016/j.compedu.2013.10.002.

Gillwald, A. (2017) 'Internet Use Barriers and User Strategies: Perspectives from Kenya, Nigeria, South Africa and Rwanda', *researchICTafrica.net*, pp. 1–5.

Gleason, N. W. (2018) 'Higher Education in the Era of the Fourth Industrial Revolution', in *Higher Education in the Era of the Fourth Industrial Revolution*, pp. 207–229. doi: 10.1007/978-981-13-0194-0.

Göktaş, Y., Yıldırım, S. and Yıldırım, Z. (2009) 'Teacher Educators ' ICT Competencies, Usage, and Perceptions', *GÜ, Gazi Eğitim Fakültesi Dergisi*, 1, pp. 109–125.

Goodwin, A. L., Low, E. L., Ng, P. T., Yeung, A. S. and Cai, L. (2015) 'Enhancing Playful Teachers' Perception of The Importance of ICT Use In The Classroom: The Role of Risk Taking As A Mediator', *Australian Journal of Teacher Education*, 40(4), pp. 133–150.

Gorard, S. (2013) *Research Design: Creating Robust Approaches for the Social Sciences*. London: Sage

Gray, D. E. (2018) *Doing Research in the Real World*. 4th edn. London: Sage

Halili, S. H. and Sulaiman, H. (2018) 'Factors Influencing the Rural Students' Acceptance of Using ICT for Educational Purposes', *Kasetsart Journal of Social Sciences*. Elsevier Ltd, pp. 1–6. doi: 10.1016/j.kjss.2017.12.022.

Hanafizadeh, M. R., Hanafizadeh, P. and Bohlin, E. (2013) 'Digital Divide and e-Readiness: Trends and Gaps', *International Journal of E-Adoption*, 2(3), pp. 30–75. doi: 10.4018/ijea.2013070103.

Heyneman, S. and Lee, B. (2016) 'International Organizations and the Future of Education Assistance', *International Journal of Educational Development,* 48, pp. 9-22.

Howard, S. K., Ma, J. and Yang, J. (2016) 'Student Rules: Exploring Patterns of Students' Computer-Efficacy and Engagement With Digital Technologies in Learning', *Computers and Education*. Elsevier Ltd, 101, pp. 29–42. doi: 10.1016/j.compedu.2016.05.008.

Hrtoňová, N., Kohout, J., Rohlikova, L. and Zounek, J. (2015) 'Factors Influencing Acceptance of E-learning by Teachers in the Czech Republic', *Computers in Human Behavior*, 51, pp. 873–879. doi: 10.1016/j.chb.2014.11.018.

Hsu, S. (2017) 'Developing and Validating a Scale for Measuring Changes in Teachers' ICT Integration Proficiency Over Time', *Computers and Education*. Elsevier Ltd, 111, pp. 18–30. doi: 10.1016/j.compedu.2017.04.001.

Hwang, I. and Cha, O. (2018) 'Examining Technostress Creators and Role Stress as Potential Threats to Employees' Information Security Compliance', *Computers in Human Behavior*. Elsevier Ltd, 81, pp. 282–293. doi: 10.1016/j.chb.2017.12.022.

Inan, F. A., and Lowther, D. L. (2010) 'Factors Affecting Technology Integration in K-12 Classrooms: A Path Model Stable URL: http://www.jstor.org/stable/40603153 , *Educational Development and Technology*, 58(2), pp. 137–154.

Islam, A. K. M. N. (2013) 'Investigating E-learning System Usage Outcomes in the University Context', *Computers and Education*. Elsevier Ltd, 69, pp. 387–399. doi: 10.1016/j.compedu.2013.07.037.

Jamil, M., Jamil, S. and Bano, S. (2016) 'Extrinsic and Intrinsic Barriers of Integrating ICTs Tools in Teaching at Undergraduate and Elementary Level: a Comparative Study', *Pakistan Journal of Social Sciences*, 36(2), pp. 1073–1087.

Jan, A. U. and Contreras, V. (2011) 'Technology Acceptance Model for the Use of Information Technology in Universities', *Computers in Human Behavior*. Elsevier Ltd, 27, pp. 845–851. doi: 10.1016/j.chb.2010.11.009.

Jena, R. K. (2015) 'Technostress in ICT Enabled Collaborative Learning Environment: An Empirical Study Among Indian Academician', *Computers in Human Behavior*. Elsevier Ltd, 51, pp. 1116–1123. doi: 10.1016/j.chb.2015.03.020.

Jeong, H. I. and Kim, Y. (2017) 'The Acceptance of Computer Technology by Teachers in Early Childhood Education', *Interactive Learning Environments*, 25(4), pp. 496–512. doi: 10.1080/10494820.2016.1143376.

Joo, J. and Sang, Y. (2013) 'Exploring Koreans' Smartphone Usage: An Integrated Model of the Technology Acceptance Model and Uses and Gratifications Theory', *Computers in Human Behavior*. Elsevier Ltd, 29(6), pp. 2512–2518. doi: 10.1016/j.chb.2013.06.002.

Joo, Y. J., Lim, K. Y. and Kim, E. K. (2011) 'Online University Students' Satisfaction and Persistence: Examining Perceived Level of Presence, Usefulness and Ease of Use as Predictors in a Structural Model', *Computers and Education*. Elsevier Ltd, 57(2), pp. 1654–1664. doi: 10.1016/j.compedu.2011.02.008.

Joo, Y. J., Lim, K. Y. and Kim, N. H. (2016) 'The Effects of Secondary Teachers'

Technostress on the Intention to Use Technology in South Korea', *Computers and Education*. Elsevier Ltd, 95, pp. 114–122. doi: 10.1016/j.compedu.2015.12.004.

Kafyulilo, A., Fisser, P. and Voogt, J. (2016) 'Factors Affecting Teachers' Continuation of Technology Use in Teaching', *Education and Information Technologies*. Education and Information Technologies, 21(6), pp. 1535–1554. doi: 10.1007/s10639-015-9398-0.

Kale, U. and Goh, D. (2014) 'Teaching Style, ICT Experience and Teachers' Attitudes Toward Teaching With Web 2.0', *Educ Inf Technol*, 19, pp. 41–60. doi: 10.1007/s10639-012-9210-3.

Kandola, D., Banner, D., McCarthy, S. O. and Jassal, D. (2014) 'Sampling Methods in Cardiovascular Nursing Research: An Overview', *Canadian journal of cardiovascular nursing*, 24(3), pp. 15–19.

Kaur, M. (2013) 'Blended Learning - its Challenges and Future', *Procedia - Social and Behavioral Sciences*. Elsevier B.V., 93, pp. 612–617. doi: 10.1016/j.sbspro.2013.09.248.

Kearney, M., Burden, K. and Rai, T. (2015) 'Investigating Teachers' Adoption of Signature Mobile Pedagogies', *Computers and Education*. Elsevier Ltd, 80, pp. 48–57. doi: 10.1016/j.compedu.2014.08.009.

Kennedy, C., Rhoads, C. and Leu, D. J. (2016) 'Online Research and Learning in Science: A One-to-One Laptop Comparison in Two States Using Performance Based Assessments', *Computers & Education*. Elsevier Ltd, 100, pp. 141–161. doi: 10.1016/j.compedu.2016.05.003.

Khatete, I. W., Wanjala, G. W., Njenga, G., Khatete, D. L. and Akala, W. J. (2015) 'Preparedness of Public Secondary Schools in Integration of Information Communication Technology in Teaching-Learning Process in Nyeri South District Kenya', *Journal of Emerging Trends in Educational Research and Policy Studies*, 6(5), pp. 371–382.

Kim, C. M., Kim, M. K., Lee, C., Spector, J. M. and DeMeester, K. (2013) 'Teacher Beliefs and Technology Integration', *Teaching and Teacher Education*. Elsevier Ltd, 29(1), pp. 76–85. doi: 10.1016/j.tate.2012.08.005.

Kirschner, P. A. and De Bruyckere, P. (2017) 'The Myths of the Digital Native and the Multitasker', *Teaching and Teacher Education*, 67, pp. 135–142. doi: 10.1016/j.tate.2017.06.001.

Koh, J. H. L. and Chai, C. S. (2016) 'Seven Design Frames that Teachers Use When Considering Technological Pedagogical Content Knowledge (TPACK)', *Computers and*

Education. Elsevier Ltd, 102, pp. 244–257. doi: 10.1016/j.compedu.2016.09.003.

Koivisto, J. and Hamari, J. (2014) 'Demographic Differences in Perceived Benefits from Gamification', *Computers in Human Behavior*. Elsevier Ltd, 35, pp. 179–188. doi: 10.1016/j.chb.2014.03.007.

Kopcha, T. J. (2012) 'Teachers' Perceptions of the Barriers to Technology Integration and Practices With Technology Under Situated Professional Development', *Computers and Education*. Elsevier Ltd, 59(4), pp. 1109–1121. doi: 10.1016/j.compedu.2012.05.014.

Korobili, S., Togia, A. and Malliari, A. (2010) 'Computer Anxiety and Attitudes Among Undergraduate Students in Greece', *Computers in Human Behavior*. Elsevier Ltd, 26(3), pp. 399–405. doi: 10.1016/j.chb.2009.11.011.

Kothari, C. (2004) *Research Methodology: Methods & Techniques*. 2ndedn.

Krauss, K. and Turpin, M. (2010) 'Towards the Emancipation of the ICT4D Researcher: Reflecting on a Case Study in Deep Rural South Africa', pp. 1–10.

Kubrický, J. and Částková, P. (2015) 'Teachers ICT Competence and their Structure as a Means of Developing Inquiry-Based Education', *Procedia - Social and Behavioral Sciences*, 186, pp. 882–885. doi: 10.1016/j.sbspro.2015.04.071.

Kuo, Y. C., Walker, A. E., Schroder, K. E. E. and Belland, B. R. (2014) 'Interaction, Internet Self-Efficacy, and Self-Regulated Learning as Predictors of Student Satisfaction in online Education Courses', *Internet and Higher Education*. Elsevier B.V., 20, pp. 35–50. doi: 10.1016/j.iheduc.2013.10.001.

Lai, C. and Hwang, G. (2016) 'A Self-Regulated Flipped Classroom Approach to Improving Students' learning performance in a Mathematics Course', *Computers & Education*. Elsevier Ltd, 100, pp. 126–140. doi: 10.1016/j.compedu.2016.05.006.

Lam, J. T., Gutierrez, M. A., Goad, J. A., Odessky, L. and Bock, J (2018) 'Use of Virtual Games for Interactive Learning in a Pharmacy Curriculum', *Currents in Pharmacy Teaching and Learning*, pp. 4–10. doi: 10.1016/j.cptl.2018.09.012.

Lee, Y. and Lee, J. (2014) 'Enhancing Pre-service Teachers' Self-efficacy Beliefs for Technology Integration Through Lesson Planning Practice', *Computers and Education*. Elsevier Ltd, 73, pp. 121–128. doi: 10.1016/j.compedu.2014.01.001.

Lim, W. N. (2017) 'Improving Student Engagement in Higher Education through Mobile-Based Interactive Teaching Model Using Socrative', in *2017 IEEE Global Engineering*

Education Conference (EDUCON). Athens, pp. 404–412.

Lin, C. A. and Kim, T. (2016) 'Predicting User Response to Sponsored Advertising on Social Media Via the Technology Acceptance Model', *Computers in Human Behavior*. Elsevier Ltd, 64, pp. 710–718. doi: 10.1016/j.chb.2016.07.027.

Lin, W. (2017) 'On Interactive Teaching Model of Translation Course Based on Wechat', *English Language Teaching*, 10(3), pp. 21–25. doi: 10.5539/elt.v10n3p21.

Litheko, S. (2012) 'The Difference in Performance Between Schools Situated in the Urban Areas and Those in the Rural Areas of Lesotho', *Electronic Journal for Inclusive Education*, 2(9), pp. 1–17. Available at: http://corescholar.libraries.wright.edu/ejie/vol2/iss9/2.

Livingstone, S. (2012) 'Critical Reflections on the Benefits of ICT in Education', *Oxford Review of Education*, 38(1), pp. 9–24. doi: 10.1080/03054985.2011.577938.

Loveless, A. and Williamson, B. (2013) *Learning Identities In A Digital Age: Rethinking Creativity, Education And Technology*. New York: Routledge.

Magher, Maria. (2018) "What Is the Meaning of Conceptual Framework in Research?" *Leaf Group Ltd,* classroom.synonym.com/meaning-conceptual-framework-research-6664512.html. Accessed 24 Oct. 2018.

Mail & Guardian (2017) 'Fourth Industrial Revolution is Upon Us: Is South Africa Ready?'

Makki, T. W., O'Neal, L. J., Cooten and Rikard, R. V (2018) 'When First-Order Barriers are High: A comparison of Second- and Third-order Barriers to Classroom Computing Integration', *Computers and Education*. Elsevier, 120, pp. 90–97. doi: 10.1016/j.compedu.2018.01.005.

Mama, M. and Hennessy, S. (2013) 'Developing a Typology of Teacher Beliefs and Practices Concerning Classroom Use of ICT', *Computers and Education*. Elsevier Ltd, 68, pp. 380–387. doi: 10.1016/j.compedu.2013.05.022.

Manwaring, K. C., Larsen, R., Graham, C. R., Henrie, C. R and Halverson, L. R. (2017) 'Investigating Student Engagement in Blended Learning Settings Using Experience Sampling and Structural Equation Modeling', *Internet and Higher Education*. Elsevier, 35, pp. 21–33. doi: 10.1016/j.iheduc.2017.06.002.

Maria Mama, T. and Hennessy, S. (2013) 'Developing a Typology of Teacher Beliefs and Practices Concerning Classroom Use of ICT', *Computers and Education*. Elsevier Ltd, 68, pp. 380–387. doi: 10.1016/j.compedu.2013.05.022.

Marín, L. M. G., Betancur, M. S. T. and Aguilar, L. J. (2016) 'Interactivity Model 2 .0: Social Communication Dynamics in Organizational Contexts', *Journal of Business Research*. Elsevier Inc., 69, pp. 4947–4952. doi: 10.1016/j.jbusres.2016.04.057.

Marzilli, C., Delello, J., Marmion, S., McWhorter, R., Roberts, P. and Marzilli, T. S. (2014) 'Faculty Attitudes Towrds Integrating Technology and Innovation', *International Journal of Integrating Technology in Education*, 3(1), pp. 1–20. doi: 10.5121/ijite.2014.3101.

Masantiah, C., Pasiphol, S. and Tangdhanakanond, K. (2018) 'Student and Feedback: Which Type of Feedback is Preferable?', *Kasetsart Journal of Social Sciences*. Elsevier Ltd, pp. 1–6. doi: 10.1016/j.kjss.2018.07.020.

Masino, S. and Niño-Zarazúa, M. (2016) 'What Works to Improve the Quality of Student Learning in Developing Countries?', *International Journal of Educational Development*, 48, pp. 53–65. doi: 10.1016/j.ijedudev.2015.11.012.

Mathevula, M. D. and Uwizeyimana, D. E. (2014) 'The Challenges Facing the Integration of ICT in Teaching and Learning Activities in South African Rural Secondary Schools', *Mediterranean Journal of Social Sciences*, 5(20), pp. 1087–1097. doi: 10.5901/mjss.2014.v5n20p1087.

McAdoo, M. L. (2015) *The Student's Survival Guide to Research*. Chicago: Neal-Schuman.

Mckenzie, F. (2017) 'The fourth Industrial Revolution and International Migration', *Lowy Institute*, 5, pp. 1–20.

McQuail, D. and Windahl, S. (2013) *Communication Models: for the Study of Mass Communications*. 2nd edn. New York: Routledge. doi: 10.1183/09059180.00000609.

Mei, B., Brown, G. T. L. and Teo, T. (2018) 'Toward an Understanding of Preservice English as a Foreign Language Teachers' Acceptance of Computer-Assisted Language Learning 2.0 in the People's Republic of China', *Journal of Educational Computing Research*. SAGE Publications: Los Angeles, 56(1), pp. 74–104. doi: 10.1177/0735633117700144.

Merriam, S. B. and Tisdell, E. J. (2015) *Qualitative Research: A Guide to Design and Implementation*. 4th edn. San Francisco: Jossey-Bass.

Miguel, L. and Okazaki, S. (2017) 'Studies in Higher Education Planned E-learning Adoption and Occupational Socialisation in Brazilian Higher Education'. Taylor & Francis, 5079. doi: 10.1080/03075079.2015.1007940.

Miniawi, H. and Brenjekjy, A. (2015) 'Educational Technology, Potentials, Expectations and

Challenges', *Procedia - Social and Behavioral Sciences*. Elsevier B.V., 174, pp. 1474–1480. doi: 10.1016/j.sbspro.2015.01.777.

Mitzner, T. L., Boron, J. B., Fausset, C. B., Adams, A. E., Charness, N., Czaja, S. J., Dijkstra, K., Fisk, A. D. and Rogers, W. A (2010) 'Older Adults Talk Technology: Technology Usage and Attitudes', *Computers in Human Behavior*, 26(6), pp. 1710–1721. doi: 10.1016/j.chb.2010.06.020.Older.

Mohammadi, H. (2015) 'Investigating Users' Perspectives on E-learning: An Integration of TAM and IS Success Model', *Computers in Human Behavior*. Elsevier Ltd, 45, pp. 359–374. doi: 10.1016/j.chb.2014.07.044.

Montaño, D. E. and Kasprzyk, D. (2015) 'Theory of Reasoned Action , Theory of Planned Behaviour, and The Integrated Behavioural Model', *Health Behavior and Health Education*, , pp. 67–96. Available at: http://riskybusiness.web.unc.edu/files/2015/01/Health-Behavior-and-Health-Education.pdf.

Moyo, M. and Mavodza, J. (2016) 'A Comparative Study of Information Literacy Provision at University Libraries in South Africa and The United Arab Emirates', *Library Review*, 65(1/2), pp. 93–107. doi: 10.1108/LR-06-2015-0069.

Muk, A. and Chung, C. (2015) 'Applying the Technology Acceptance Model in a Two-Country Study of SMS Advertising', *Journal of Business Research*. Elsevier Inc., 68, pp. 1–6. doi: 10.1016/j.jbusres.2014.06.001.

Mumtaz, S. (2017) 'Factors Affecting Teachers' Use of Information and Communications Technology: A Review of the Literature Factors Affecting Teachers' Use of Information and Communications'. doi: 10.1080/14759390000200096.

Murphy, M. and Sashi, C. M. (2017) 'Communication, Interactivity, and Satisfaction in B2B Relationships', *Industrial Marketing Management*. Elsevier, 68, pp. 1–12. doi: 10.1016/j.indmarman.2017.08.020.

Musakophas, R. and Polnigongit, W. (2017) 'Current and Future Studies on Participatory Communication in Thailand', *Kasetsart Journal of Social Sciences*. Elsevier Ltd, 38(1), pp. 68–73. doi: 10.1016/j.kjss.2016.01.011.

Mutua, F. K. and Ng'eno, W. K. (2016) 'Determinants of E-Learning in Secondary Schools in Kenya: A Case of Selected Public Secondary Schools in Westlands District in Nairobi City County', *International Journal of Humanities Social Sciences and Education*, 3(9), pp. 29–41.

Mwalongo, A. (2011) 'Teachers' Perceptions About ICT for Teaching, Professional Development, Administration and Personal Use', *IJEDICT*, 7(3), pp. 36–49.

Naidoo, G. M., Rugbeer, Y. and Rugbeer, H. (2013) 'Implications of Web 2.0 Computing for Education in South Africa', 31(1), pp. 83–93.

Ndlovu, N. S. and Lawrence, D. (2012) 'The Quality of ICT in South African Classrooms', in *'Towards Carnegie III'*, pp. 1–26.

Neuman, W. L. (2009) *Understanding Research*. Boston: Pearson Education.

Ngai, E. W. T., Tao, S. S. C. and Moon, K. K. L. (2015) 'Social Media Research: Theories, Constructs, and Conceptual Frameworks', *International Journal of Information Management*. Elsevier Ltd, 35(1), pp. 33–44. doi: 10.1016/j.ijinfomgt.2014.09.004.

Nguyen, K. T., Laurent, M. and Oualha, N. (2015) 'Survey on Secure Communication Protocols for the Internet of Things', *Ad Hoc Networks*. Elsevier B.V., 32(2015), pp. 17–31. doi: 10.1016/j.adhoc.2015.01.006.

Ní Ríordáin, M., Paolucci, C. and O' Dwyer, L. M. (2017) 'An Examination of the Professional Development Needs of Out-of-Field Mathematics Teachers', *Teaching and Teacher Education*, 64, pp. 162–174. doi: 10.1016/j.tate.2017.02.001.

Nolan, J. and McBride, M. (2014) 'Beyond Gamification: Reconceptualizing Game- Based Learning in Early Childhood Environments', *Information, Communication & Society*, 17(5), p. 59608. doi: 10.1080/1369118X.2013.808365.

Noor-ul-amin, S. (2013) 'An Effective Use of ICT for Education and Learning by Drawing on Worldwide Knowledge, Research and Experience: ICT as a Change Agent for Education (A Literature review)', *Scholarly Journal of Education*, 2(4), pp. 38–45.

Novotný, L., hruska, V., Egedy, T. and Mazur, M. (2015) 'Defining Rural Areas of Visegrad Countries', *Studia Obszarów Wiejskich*, 39, pp. 21–34. doi: 10.7163/SOW.39.2.

Nyahodza, L. and Higgs, R. (2017) 'Towards Bridging The Digital Divide In Post-Apartheid South Africa: A Case of a Historically Disadvantaged University In Cape Town', *South African Journal of Libraries and Information Science*, 83(1), pp. 39–49. doi: 10.7553/83-1-1645.

Nyambura, M., Odufuwa, F., Nsengiyumva, A., Mdleleni, L., Moyo, M. and Mthinkhulu, S.

(2017) 'Internet Use Barriers and User Strategies: Perspectives from Kenya, Nigeria, South Africa and Rwanda Chenai Chair Analysis Based on Country Case Studies', pp. 1–5. Available at: https://www.researchictafrica.net/publications/Other_publications/2017_Internet use barrier and user strategies_Executive_Summary.pdf.

O'Bannon, B. W. and Thomas, K. (2014) 'Teacher Perceptions of Using Mobile Phones in the Classroom: Age Matters!', *Computers and Education*. Elsevier Ltd, 74, pp. 15–25. doi: 10.1016/j.compedu.2014.01.006.

Oesch, D. (2013) 'Occupational Change in Europe: How Technology and Education Transform the Job Structure', *Oxford University Press*. doi: 10.1093/acprof.

Omotayo, K. A., Ajayi, P. O. and Ayodele, M. A. (2013) 'Acquiring Scientific Literacy via E-Learning in Secondary Schools in Ekiti-State , Nigeria Corresponding Author : Ajayi , Peter O', 5(1), pp. 73–75.

Onofrei, S. G. and Iancu, L. (2015) 'The Role of New Technology in Teaching Through Proverbs in Primary School', *Procedia - Social and Behavioral Sciences*, 203, pp. 130–133. Available at: https://doi.org/10.1016/j.sbspro.2015.08.270.

Osakwe, J., Dlodlo, N. and Jere, N. (2017) 'Technology in Society Where Learners' and Teachers' Perceptions on Mobile Learning Meet : A Case of Namibian Secondary Schools in the Khomas Region', *Technology in Society*. Elsevier Ltd, 49, pp. 16–30. doi: 10.1016/j.techsoc.2016.12.004.

Ottenbreit-leftwich, A. T., Brush, T. A., Strycher, J., Gonseth, S., Roman, T., Abaci, S., Van Leusen, P., Shin, S., Easterling, W. and Plucker, J. (2012) 'Preparation Versus Practice: How do Teacher Education Programs and Practicing Teachers Align in their Use of Technology to Support Teaching and Learning?', *Computers & Education*. Elsevier Ltd, 59(2), pp. 399–411. doi: 10.1016/j.compedu.2012.01.014.

Ouma, G. O., Awuor, F. M. and Kyambo, B. (2013) 'Evaluation of E-Learning Readiness in Secondary Schools in Kenya', *World Applied Programming*, 3(10), pp. 493–503.

Pachler, N., Daly, C., Mor, Y. and Mellar, H. (2010) 'Formative e-Assessment: Practitioner Cases', *Computers and Education*. Elsevier Ltd, 54(3), pp. 715–721. doi: 10.1016/j.compedu.2009.09.032.

Padayachee, K. (2017) 'A Snapshot Survey of ICT Integration in South African schools', *South African Computer Journal*, 29(2), pp. 36–65. doi: 10.18489/sacj.v29i2.463.

Padilla-Meléndez, A., Aguila-Obra, A. R. and Garrido-Moreno, A. (2013) 'Perceived Playfulness, Gender Differences and Technology Acceptance Model in a Blended Learning Scenario', *Computers & Education*, 63, pp. 306–317. doi: 10.1016/j.compedu.2012.12.014.

Pajo, B. (2018) *Introduction to Research Methods: A Hands-On Approach*. Los Angels: Sage Publications.

Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N. and Hoagwood, K. (2015) 'Purposeful Sampling for Qualitative Data Collection and Analysis in Mixed Method Implementation Research', *Administration and Policy in Mental Health and Mental Health Services Research*. Springer US, 42, pp. 533–544. doi: 10.1007/s10488-013-0528-y.

Palomino, M. del C. P. (2017) 'Teacher Training in the Use of ICT for Inclusion: Differences Between Early Childhood and Primary Education', *Procedia - Social and Behavioral Sciences*. 237, pp. 144–149. doi: 10.1016/j.sbspro.2017.02.055.

Park, N., Kim, Y., Shon, H. Y. and Shim, H. (2013) 'Factors Influencing Smartphone Use and Dependency in South Korea', *Computers in Human Behavior*. Elsevier Ltd, 29(4), pp. 1763–1770. doi: 10.1016/j.chb.2013.02.008.

Pavel, A., Fruth, A. and Neacsu, M. (2015) 'ICT and E-Learning – Catalysts for Innovation and Quality in Higher Education', *Procedia Economics and Finance*. Elsevier B.V., 23, pp. 704–711. doi: 10.1016/S2212-5671(15)00409-8.

Perbawaningsih, Y. (2013) 'Plus Minus of ICT Usage in Higher Education Students', in *13th International Educational Technology Conference*. Indonesia: Elsevier B.V., pp. 717–724. doi: 10.1016/j.sbspro.2013.10.392.

Perrotta, C. (2013) 'Do School-Level Factors Influence the Educational Benefits of Digital Technology? A Critical Analysis of Teachers' Perceptions.', *British Journal of Education*, 44(2), pp. 1–18.

Persico, D., Manca, S. and Pozzi, F. (2014) 'Adapting the Technology Acceptance Model to Evaluate the Innovative Potential of E-learning Systems', *Computers in Human Behavior*. Elsevier Ltd, 30, pp. 614–622. doi: 10.1016/j.chb.2013.07.045.

Peters, M. A. (2017) 'Technological Unemployment: Educating for the Fourth Industrial Revolution Technological Unemployment', *Educational Philosophy and Theory*. Routledge, 49(1), pp. 1–6. doi: 10.1080/00131857.2016.1177412.

Petko, D. (2012) 'Teachers' Pedagogical Beliefs and their Use of Digital Media in Classrooms: Sharpening the Focus of the "Will, Skill, Tool" Model and Integrating

Teachers' Constructivist Orientations', *Computers and Education*. Elsevier Ltd, 58(4), pp. 1351–1359. doi: 10.1016/j.compedu.2011.12.013.

Pigato, M. (2001) 'Information and Communication, Technology, Poverty, and Development in sub-Saharan Africa and South Asia', (20).

Pinhati, F. and Siqueira, S. W. M. (2014) 'Music Students' Behavior on Using Learning Objects Closer to the Domain Characteristics and the Social Reality', *Computers in Human Behavior*. Elsevier Ltd, 30, pp. 760–770. doi: 10.1016/j.chb.2013.10.039.

Pirvu, B. C. and Zamfirescu, C. B. (2017) 'Smart Factory in the Context of 4th Industrial Revolution: Challenges and Opportunities for Romania', *IOP Conference Series: Materials Science and Engineering*, 227(1). doi: 10.1088/1757-899X/227/1/012094.

Piva, M. and Vivarelli, M. (2018) 'Is Innovation Destroying Jobs? Firm-Level Evidence from the EU', *Sustainability*, pp. 1–16. doi: 10.3390/su10041279.

Prensky, M. (2001) 'Digital Natives, Digital Immigrants Part 1', *On the Horizon*, 9(5), pp. 1–6.

Prestridge, S. (2012) 'The Beliefs Behind the Teacher that Influences their ICT Practices', *Computers and Education*. Elsevier Ltd, 58(1), pp. 449–458. doi: 10.1016/j.compedu.2011.08.028.

Ragin, C. C. and Amoroso, L. M. (2011) *Constructing Social Research: The Unity and Diversity of Method*. 2nd edn. California: Sage Publishers.

Ramirez, G. M., Collazos, C. A. and Moreira, F. (2018) 'All-Learning: The State of the Art of the Models and the Methodologies Educational With ICT', *Telematics and Informatics*. Elsevier, 35(4), pp. 944–953. doi: 10.1016/j.tele.2017.10.004.

Rao, J. and Ye, J. (2016) 'From a Virtuous Cycle of Rural-Urban Education to Urban-Oriented Rural Basic Education in China: An Explanation of the Failure of China's Rural School Mapping Adjustment policy', *Journal of Rural Studies*, 47, pp. 601–611. Available at: http://dx.doi.org/10.1016/j.jrurstud.2016.07.005.

Ratcliffe, M., Burd, C., Holder, K. and Fields, A. (2016) 'Defining Rural at the U.S. Census Bureau - ACSGEO-1', *U.S. Censusu Bureau*, pp. 1–8. doi: 10.13140/RG.2.2.16410.64969.

Ravizza, S. M., Hambrick, D. Z. and Fenn, K. M. (2014) 'Non-Academic Internet Use in the Classroom is Negatively Related to Classroom Learning Regardless of Intellectual Ability', *Computers and Education*. Elsevier Ltd, 78, pp. 109–114. doi:

10.1016/j.compedu.2014.05.007.

Redempta, K. and Elizabeth, M. (2012) 'An E-Learning Approach to Secondary School Education": E-Readiness Implications in Kenya', *Journal of Education and Practice*, 3(16), pp. 142–148. Available at: http://www.iiste.org/Journals/index.php/JEP/article/view/3707%5Cnhttp://www.iiste.org/Journals/index.php/JEP/article/viewFile/3707/3756 [Accessed: 14 June 2017].

Renny, Guritno, S. and Siringoringo, H. (2013) 'Perceived Usefulness, Ease of Use, and Attitude Towards Online Shopping Usefulness Towards Online Airlines Ticket Purchase', *Procedia - Social and Behavioral Sciences*. Elsevier B.V., 81, pp. 212–216. doi: 10.1016/j.sbspro.2013.06.415.

Rienties, B., Giesbers, B., Lygo-Baker, S. Ma, H. W. S. and Ree, R. (2016) 'Why Some Teachers Easily Learn to Use a New Virtual Learning Environment: a Technology Acceptance Perspective', *Interactive Learning Environments*, 24(3), pp. 539–552. doi: 10.1080/10494820.2014.881394.

Robson, K., Plangger, K., Kietzmann, J. H., McCarthy, I. and Pitt, L. (2015) 'Is it All a Aame? Understanding the Principles of Gamification', *Business Horizons*. 'Kelley School of Business, Indiana University', 58, pp. 411–420. doi: 10.1016/j.bushor.2015.03.006.

Rubin, R. B., Rubin, A. M., Haridakis, P. M and Piele, L. J. (2010) *Communication Research: Strategies and Sources*. Canada: Wadsworth.

Sabzian, F. and Gilakjani, A. P. (2013) 'Teachers' Attitudes about Computer Technology Training, Professional Development, Integration, Experience, Anxiety, and Literacy in English Language Teaching and Learning', *International Journal of Applied Science and Technology*, 3(1), pp. 67–75.

Sánchez, A.-B., Marcos, J. M., Gonzalez, M. and GuanLin, H. (2012) 'In Service Teachers' Attitudes towards the Use of ICT in the Classroom', *Procedia - Social and Behavioral Sciences*, 46, pp. 1358–1364. doi: 10.1016/j.sbspro.2012.05.302.

Scherer, R., Siddiq, F. and Teo, T. (2015) 'Becoming more Specific: Measuring and Modeling Teachers' Perceived Usefulness of ICT in the Context of Teaching and Learning', *Computers and Education*. Elsevier Ltd, 88, pp. 202–214. doi: 10.1016/j.compedu.2015.05.005.

Scherer, R., Siddiq, F. and Tondeur, J. (2018) 'The Technology Acceptance Model (TAM): A Meta-Analytic Structural Equation Modeling Approach To Explaining Teachers' Adoption of Digital Technology in Education', *Computers & Education*, 128, pp. 13–35.

doi: 10.1016/j.compedu.2018.09.009.

Schoonenboom, J. (2014) 'Using An Adapted, Task-Level Technology Acceptance Model To Explain Why Instructors In Higher Education Intend To Use Some Learning Management System Tools More Than Others', *Computers and Education*. Elsevier Ltd, 71, pp. 247–256. doi: 10.1016/j.compedu.2013.09.016.

Schroeder, A., Minocha, S. and Schneider, C. (2010) 'The Strengths, Weaknesses, Opportunities and Threats of Using Social Software in Higher and Further Education Teaching and Learning', *Journal of Computer Assisted Learning*, 26, pp. 159–174. doi: 10.1111/j.1365-2729.2010.00347.x.

Schwab, K. (2016) 'The Fourth Industrial Revolution', *World Economic Forum*, doi: 10.1017/CBO9781107415324.004.

Seiler, W. and Beall, M. (2011) *Communication: Making Connections*. Boston: Pearson.

Sein-Echaluce, M. L., Fidalgo-Blanco, Á. and Alves, G. (2017) 'Technology Behaviors in Education Innovation', *Computers in Human Behavior*, 72, pp. 596–598. doi: 10.1016/j.chb.2016.11.049.

Sherman, K. and Howard, S. K. (2012) 'Teachers' Beliefs about First-and Second-Order Barriers to ICT Integration: Preliminary Findings from a South African Study', in *23rd International Conference of Society for Information Technology and Teacher Education*, pp. 2098–2105.

Siddiq, F., Hatlevik, O. E., Olsen, R. V., Throndsen, I. and Schere, R. (2016) 'Taking a Future Perspective by Learning from the Paste A Systematic Review of Assessment Instruments that Aim to Measure Primary and Secondary School Students' ICT', *Educational Research Review*. Elsevier Ltd, 19, pp. 58–84. doi: 10.1016/j.edurev.2016.05.002.

Šimandl, V. and Vaníček, J. (2017) 'Influences on ICT Teachers Knowledge and Routines in a Technical e-Safety Context', *Telematics and Informatics*, 34, pp. 1488–1502. doi: 10.1016/j.tele.2017.06.012.

Singh, T. J. and Sahu, S. K. (2016) *Research Methodology*:Latest eddition.SBPD Publications.

Sipilä, K. (2013) 'Educational Use of Information and Communications Technology: Teachers' Perspective', *Technology, Pedagogy and Education*. Routledge, 23(2), pp. 225–241. doi: 10.1080/1475939X.2013.813407.

Sipilä, K. (2014) 'Educational Use of Information and Communications Technology: Teachers' Perspective', *Technology, Pedagogy and Education*. Routledge, 23(2), pp. 225–241. doi: 10.1080/1475939X.2013.813407.

Smith, N. V. (2013) 'Face-to-Face vs. Blended Learning: Effects on Secondary Students' Perceptions and Performance', *Procedia - Social and Behavioral Sciences*. Elsevier Ltd, 89, pp. 79–83. doi: 10.1016/j.sbspro.2013.08.813.

Soler, R., Soler, J. R. and Araya, I. (2017) 'Subjects in the Blended Learning Model Design: Theoretical- Methodological Elements', *Procedia - Social and Behavioral Sciences*. pp. 771–777. doi: 10.1016/j.sbspro.2017.02.120.

Solomon, D. and Theiss, J. (2013) *Interpersonal Communication: Putting Theory into Practice*. New York: Routledge.

Steinberg, S. (2007) *An Introduction to Communication Studies*. Cape Town: Juta.

Strasburger, V. C. and Hogan, M. J. (2013) 'Children, Adolescents, and the Media', *Clinical Pediatrics*, 132, pp. 958–961. doi: 10.1177/0009922815616070.

Subhash, S. and Cudney, E. A. (2018) 'Gamified Learning in Higher Education: A Systematic Review of the Literature', *Computers in Human Behavior*, 87, pp. 192–206. doi: 10.1016/j.chb.2018.05.028.

Tamayo, M., Rebolledo, J. and Besoaín-Saldaña, A. (2017) 'Monitoring Inclusive Education in Chile: Differences Between Urban and Rural Areas', *International Journal of Educational Development*, 53, pp. 110–116. doi: 10.1016/j.ijedudev.2017.01.002.

Tambotoh, J. J. C., Manuputty, A. D. and Banunaek, F. E. (2015) 'Socio-economics Factors and Information Technology Adoption in Rural Area', in *The Third Information Systems International Conference*. Elsevier B.V., pp. 178–185. doi: 10.1016/j.procs.2015.12.119.

Tarhini, A., Hone, K., Liu, X and Tarhini, T (2017) 'Examining the Moderating Effect of Individual Level Cultural Values on Users' Acceptance of E-learning in Developing Countries: A Structural Equation Modeling of an Extended Technology Acceptance Model', *Interactive Learning Environments*. Taylor & Francis, 25(3), pp. 306–328. doi: 10.1080/10494820.2015.1122635.

Tayebinik, M. and Puteh, M. (2013) 'Blended Learning or E-learning ?'

Teo, T. (2010) 'A Path Analysis of Pre-service Teachers' Attitudes to Computer Use: Applying and Extending the Technology Acceptance Model in an Educational Context',

Interactive Learning Environments ISSN:, 18(1), pp. 65–79. doi: 10.1080/10494820802231327.

Teo, T., Milutinovic, V. and Zhou, M. (2016) 'Modelling Serbian Pre-service Teachers' Attitudes Towards Computer Use: A SEM and MIMIC Approach', *Computers & Education*, 94, pp. 77–88. doi: 10.1016/j.compedu.2015.10.022.

Teo, T. and Noyes, J. (2014) 'Explaining the Intention to Use Technology Among Pre-service Teachers: A Multi-group Analysis of the Unified Theory of Acceptance and Use of Technology', *Interactive Learning Environments*, 22(1), pp. 51–66. doi: 10.1080/10494820.2011.641674.

Tire, T. and Mlitwa, N. (2015) 'ICT Access and Use in Rural Schools in South Africa: The Northern Cape Province', *IS, ICT & e-Commerce, e-Health, e-Learning*, pp. 141–154.

Tivener, K. A. and Hetzler, T. (2015) 'The Effects of an Electronic Audience Response System on Athletic Training Student Knowledge and Interactivity', *Train Educ J. Athletic Training Education Journal*, 10(3), pp. 212–218. doi: 10.4085/1003212.

To, W. M. and Tang, M. N. F. (2018) 'Computer-based Course Evaluation: An Extended Technology Acceptance Model', *Educational Studies*, 5698, pp. 1–14. doi: 10.1080/03055698.2018.1443797.

Tondeur, J., Roblin, P. N., Van Braak, J., Voogt, J. and Prestridge, S. (2017) 'Preparing Beginning Teachers for Technology Integration in Education: Ready for Take-off?', *Technology, Pedagogy and Education*. Routledge, 26(2), pp. 157–177. doi: 10.1080/1475939X.2016.1193556.

Tondeur, J., van Braak, J., Ertmer, P. A. and Ottenbreit-Lefttwich, A. (2017) 'Understanding the Relationship Between Teachers' Pedagogical Beliefs and Technology Use in Education: A Systematic Review of Qualitative Evidence', *Educational Technology Research and Development*. Springer US, 65, pp. 555–575. doi: 10.1007/s11423-016-9481-2.

Tondeur, J., Aesaert, K., Prestridge, S. and Consuegra, E. (2018) 'A multilevel Analysis of What Matters in the Training of Pre-service Teacher's ICT Competencies', *Computers and Education*. Elsevier, 122, pp. 32–42. doi: 10.1016/j.compedu.2018.03.002.

Triyono, M. B. (2015) 'The Indicators of Instructional Design for E- learning in Indonesian Vocational High Schools', in *4th World Congress on Technical and Vocational Education and Training (WoCTVET), 5th–6th November 2014, Malaysia*. Malaysia: Elsevier, pp. 54–61. doi: 10.1016/j.sbspro.2015.08.109.

Uluyol, Ç. and Sahin, S. (2016) 'Elementary School Teachers' ICT Use in the Classroom and their Motivators for Using ICT', *British Journal of Educational Technology*, 47(1), pp. 65–75. doi: 10.1111/bjet.12220.

Umar, I. N. and Hassan, A. S. A. (2015) 'Malaysian Teachers' Levels Of ICT Integration And its Perceived Impact On Teaching And Learning', *Procedia - Social and Behavioral Sciences*. Elsevier B.V., 197, pp. 2015–2021. doi: 10.1016/j.sbspro.2015.07.586.

Umar, I. N. and Jalil, N. A. (2012) 'ICT Skills, Practices and Barriers of Its Use Among Secondary School Students', *Procedia - Social and Behavioral Sciences*, 46, pp. 5672–5676. doi: 10.1016/j.sbspro.2012.06.494.

Umar, I. N., Tarmizi, M. and Yusoff, M. (2014) 'A Study on Malaysian Teachers' Level Of ICT Skills And Practices, And Its Impact On Teaching And Learning', *Procedia - Social and Behavioral Sciences*. Elsevier B.V., 116, pp. 979–984. doi: 10.1016/j.sbspro.2014.01.331.

Van Den Beemt, A. and Diepstraten, I. (2016) 'Teacher Perspectives on ICT: A learning Ecology Approach', *Computers and Education*. Elsevier Ltd, 92–93, pp. 161–170. doi: 10.1016/j.compedu.2015.10.017.

Vandeyar, T. (2013) 'Practice as Policy in ICT for Education: Catalysing Communities of Practice in Education in South Africa', *Technology in Society*. Elsevier Ltd, 35, pp. 248–257. doi: 10.1016/j.techsoc.2013.10.002.

Venkatesh, V. (2000) 'Determinants of Perceived Ease of Use: Integrating Control, Instrict Motivation, and Emotion into the Technology Acceptance Model', *Information Systems Research*, 11(4), pp. 342–365.

Venkatesh, V., Morris, M. G., Davis, G. B. and Davis, F. D. (2003) 'User Acceptance of Information Technology: Toward A Unified View', *MIS Quarterly*, 27(3), pp. 425–478.

Venkatesh, V. and Bala, H. (2008) 'Technology Acceptance Model 3 and a Research Agenda on Interventions', *Decision Sciences*, 39(2), pp. 273–315.

Venkatesh, V. and Davis, F. D. (2000) 'A Theoretical Extension of the Technology Acceptance Model: Four longitudinal Field Studies', *Management Science*, 46. doi: 10.1287/mnsc.46.2.186.11926.

Vitanova, V., Atanasova-Pachemska, T., Iliev, D. and Pachemska, S. (2015) 'Factors Affecting the Development of ICT Competencies of Teachers in Primary Schools', *Procedia - Social and Behavioral Sciences*. Elsevier B.V., 191, pp. 1087–1094. doi: 10.1016/j.sbspro.2015.04.344.

Von Der Embse, N. P., Sandilos, L. E., Pendergast, L. and Mankin, A. (2016) 'Teacher Stress, Teaching-Efficacy, and Job Satisfaction in Response to Test-Based Educational Accountability Policies', *Learning and Individual Differences*. Elsevier Inc., 50, pp. 308–317. doi: 10.1016/j.lindif.2016.08.001.

Walliman, N. (2018) Research Methods: The Basics. 2nd edn. New York: Routledge.

Wang, Q., Myers, M. D. and Sundaram, D. (2013) 'Digital Natives and Digital Immigrants: Towards a Model of Digital Fluency', *Business and Information Systems Engineering*, 5(6), pp. 409–419. doi: 10.1007/s12599-013-0296-y.

Wassermann, S. (2017) *The Art of Interactive Teaching: Listening, Responding, Questioning*. New York: Routledge.

Wastiau, P., Blamire, R., Kearney, C., Quittre, V., Van de Gaer, E. and Monseur, C. (2013) 'The Use of ICT in Education : A Survey of Schools in Europe'.

Welman, C., Kruger, F. and Mitchell, B. (2005) *Research Methodology*. 3rd edn. Cape Town: Oxford University Press.

Wilson-Strydon, M. and Thomson, J. (2013) 'Understanding ICT integration in South African Classrooms'.

Wilson, M., Scalise, K. and Gochyyev, P. (2015) 'Rethinking ICT literacy: From Computer Skills to Social Network Settings.', *Thinking Skills and Creativity*. Elsevier Ltd, 18, pp. 65–80. Available at: http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=psyc12&NEWS=N&AN=2015-42631-001.

Wirzberger, M., Beege, M., Schneuder, S., Nebel, S. and Rey, G. D. (2016) 'One for all?! Simultaneous Examination of Load-Inducing Factors for Advancing Media-Related Instructional Research', *Computers & Education*. Elsevier Ltd, 100, pp. 18–31. doi: 10.1016/j.compedu.2016.04.010.

Wu, J. H., Tennyson, R. D. and Hsia, T. L. (2010) 'A Study of Student Satisfaction in a Blended E-learning System Environment', *Computers and Education*. Elsevier Ltd, 55(1), pp. 155–164. doi: 10.1016/j.compedu.2009.12.012.

Yen, D. C., Wu, C-S., Cheng, F-F. and Huang, Y-W. (2010) 'Determinants of Users' Intention to Adopt Wireless Technology: An Empirical Study by Integrating TTF with TAM', *Computers in Human Behavior*. Elsevier Ltd, 26(5), pp. 906–915. doi: 10.1016/j.chb.2010.02.005.

Yoon, H. S. and Barker Steege, L. M. (2013) 'Development of a Quantitative Model of the Impact of Customers' Personality and Perceptions on Internet Banking Use', *Computers in Human Behavior*, 29(3), pp. 1133–1141. doi: 10.1016/j.chb.2012.10.005.

Yunus, M. M., Nordin, N., Salehi, H., Sun, C. H. and Embi, M. A. (2013) 'Pros and Cons of Using ICT in Teaching ESL Reading and Writing', *International Education Studies*, 6(7), pp. 119–130. doi: 10.5539/ies.v6n7p119.

Zhang, C. B. and Lin, Y. H. (2015) 'Exploring Interactive Communication Using Social Media', *The Service Industries Journal*, 35, pp. 670–693. Available at: http://dx.doi.org/10.1080/02642069.2015.1064396.

Zhang, Z. V and Hyland, K. (2018) 'Student Engagement with Teacher and Automated Feedback on L2 Writing', *Assessing Writing*. Elsevier, 36(July 2017), pp. 90–102. doi: 10.1016/j.asw.2018.02.004.

Zyad, H. (2016) 'Integrating Computers in the Classroom: Barriers and Teachers' Attitudes', *International Journal of Instruction*, 9(1), pp. 65–78. doi: 10.12973/iji.2016.916a.

Addendum 1: Information Sheet

For office use: Respondent Number: _____

INFORMATION SHEET

Innovative Communication Protocols for Teaching in Rural Secondary Schools.
University of Zululand
Department of Communication Science

Researcher: Minenhle Madida

Supervisor: Dr G.M Naidoo   Co-supervisor: Prof H Rugbeer

I am interested in your opinion about the use of innovative communication protocols for teaching in rural schools. Innovative communication protocols deal with media technologies such as ICT, amongst many. You are not compelled to participate in this survey. Your remarks will remain private and confidential. Please answer the questions truthfully.

- Please use a pen to mark your responses by placing a tick (✓) or a cross (**X**) in the appropriate column.
- Please do not change your response by scratching out or using tippex.

Your participation is appreciated

Contact details: Minenhle Madida,

Cell no: +27-83 9903630, E-mail: msmadida@gmail.com

Addendum 2: The Questionnaire

Section A: Personal and Background Information

Please fill in the following information. Your personal information will **NOT** be revealed when the results of the study are published. *Please indicate with a tick (✔) or a cross (X).*

1. **Your gender**

Male	1
Female	2

2. **Your age**

20 – 34 years old	1
35 – 45 years old	2
Above 45 years old	3
I do not want to answer this question	4

3. **Your teaching experience**

1 – 5 years' experience	1
6 – 10 years' experience	2
11 – 20 years' experience	3
Over 20 years' experience	4
I do not want to answer this question	5

4. **What level do you teach?**

Lower level (grade 8 – 9)	1
Upper level (grade 10 – 11)	2
I do not want to answer this question	3

5. **Average number of learners in a classroom**

25 – 33 learners	1
34 – 40 learners	2
Above 40 learners	3
I do not want to answer this question	4

Section B

*The extent of ICT exposure amongst teachers. **Please indicate your response by placing a (✓) or a cross (X) in the appropriate box.***

6. Does your school have any Information and Communication Technology (ICT) facilities, such as computers or internet access?

Yes	1
No	2
I do not want to answer this question	3

7. Does your school provide any ICT training for teachers?

Yes	1
No	2
I do not want to answer this question	3

8. How often does the school provide professional development opportunities, such as training?

Per term	1
Per semester	2
Per year	3
Never	4
I do not want to answer this question	5

9. **To what extent are you comfortable using ICT for the following?**

	Good	Fair	Poor	I don't want to answer this
9.1 Produce typed documents	1	2	3	4
9.2 PowerPoint presentation for teaching	1	2	3	4
9.3 Search for information on the internet	1	2	3	4
9.4 Produce graphs and illustrations for teaching purposes	1	2	3	4
9.5 Communicate via emails with other teachers	1	2	3	4
9.6 Send files/ documents to others	1	2	3	4

10. From the list below, please indicate the teaching aids available in your school. **You may choose more than one**

10.1 Chalkboard	
10.2 Projector	
10.3 Television	
10.4 Radio	
10.5 Flip charts	
10.6 The internet	
10.7 Textbooks	
10.8 eBooks	
10.9 Posters	

Based on your teaching experience, what are your perceptions towards the use of ICT in the classroom?

Please indicate your response by placing a tick (✔) or a cross (X) below

Statement	False	True	Not Sure
11. The use of ICT for teaching and learning would bring positive change in the classroom.	1	2	3
12. The use of technologies in the classroom would bring distraction.	1		3
13. The use of ICT for classroom instruction will diminish learners' writing skills.	1	2	3
14. Learners would benefit from the use of ICT in the classroom by accessing up-to-date information that may improve on their performance.	1	2	3
15. Technology-enhanced classroom environments could encourage learners to participate in learning activities.	1	2	3
16. The use of ICT in schools would help the teachers to prepare their lessons better.	1	2	3
17. The use of ICT would help in identifying and addressing learner's individual needs.	1	2	3
18. The use of ICT would help teachers to effectively communicate with all their learners.	1	2	3
19. The use of ICT would help to cover the syllabus on time and provide enough time for revision.	1	2	3

What are some of the challenges you face with regards to using ICT for teaching and learning?

Please indicate your response by placing a tick (✓) or a cross (X)

	Agree	Disagree	Neither agree nor Disagree
20. Lack of computer skills	1	2	3
21. Lack of skills to integrate ICT into the curriculum	1	2	3
22. Lack of interest in ICTs	1	2	3
23. The use of ICT is not a priority in our school	1	2	3
24. Our school computers are outdated and not maintained	1	2	3
25. Our school does not have the facilities	1	2	3

From the answers you provided is there anything you would like to add concerning the use of Innovative communication protocols, such as ICT, in the classroom?

Please use the space below

_____

_____

_____

_____

_____

_____

_____

_____

Thank you for your participation!

Addendum 3: Letter to Request Permission from The Principals

<div align="right">

P. O Box 84

Empangeni

3880

27 August 2018
</div>

The Principal

<div align="center">

REQUEST FOR PERMISSION TO CONDUCT RESEARCH
</div>

I am a registered Master's student in the Department of Communication Science at the University of Zululand. My supervisors are Dr G.M. Naidoo and Prof H. Rugbeer.

The proposed topic of my research is *Innovative Communication Protocols for Teaching in Rural Secondary Schools*.

The objectives of the study are:

a) To examine the extent of communication technologies being used amongst teachers in rural secondary schools.
b) To determine the teachers' perceptions towards the use of new communication protocols for instruction within rural classrooms.
c) To investigate factors affecting the effective use of new communication protocols in rural secondary schools.

I hereby seek your consent to approach staff within your school to provide responses for this project. To assist you in reaching a decision, I have attached to this letter:

(a) A copy of an ethical clearance certificate issued by the University

(b) A copy the research instrument which I intend to use in my research

Should you require any further information, please do not hesitate to contact me or my supervisor. Our contact details are as follows:
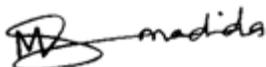
Researcher: Minenhle Madida (083 990 3630) / msmadida@gmail.com
Supervisor: Dr G. M. Naidoo (035-9026164) / NaidooG@unizulu.ac.za
Co-supervisor: Professor H. Rugbeer (035-9026210) / RugbeerH@unizulu.ac.za

Your permission to conduct this study will be greatly appreciated.

Yours sincerely,

138

Addendum 4: Letter to Request Permission from the District

<div align="right">

PO Box 84

Empangeni

3880

21 August 2018

</div>

The District Manager

The King Cetshwayo District Office of Education

Private Bag X14

Empangeni

KwaZulu-Natal

3910

Dear Sir/Madam

<div align="center">

REQUEST FOR PERMISSION TO CONDUCT RESEARCH

</div>

I am a registered Master's student in the Department of Communication Science at the University of Zululand. My supervisors are Dr G.M. Naidoo and Prof H. Rugbeer.

The proposed topic of my research is ***Innovative Communication Protocols for Teaching in Rural Secondary Schools***.

The objectives of the study are:

a) To examine the extent of communication technologies being used amongst teachers in rural secondary schools.

b) To determine the teachers' perceptions towards the use of new communication protocols for instruction within rural classrooms.

c) To investigate factors affecting the effective use of new communication protocols in rural secondary schools.

I hereby seek your consent to use schools within the King Cetshwayo District as data collection sites. To assist you in reaching a decision, I have attached to this letter:

a) A copy of an ethical clearance certificate issued by the University
b) A copy the research instrument which I intend to use in my research

Should you require any further information, please do not hesitate to contact me or my supervisor. Our contact details are as follows:

Researcher: Minenhle Madida (083 990 3630) / msmadida@gmail.com

Supervisor: Dr G. M. Naidoo (035-9026164) / NaidooG@unizulu.ac.za

Co-supervisor: Professor H. Rugbeer (035-9026210) / RugbeerH@unizulu.ac.za

Upon completion of the study, I undertake to provide you with a copy of the dissertation.

Your permission to conduct this study will be highly appreciated.

Yours sincerely,

_____

Minenhle Madida

Addendum 5: Letter to Request Permission from KZN Provincial HOD of Basic Education

<div align="right">

PO Box 84

Empangeni

3880

20 August 2018

</div>

Dr EV Nzama

Head of Department: Education: KwaZulu-Natal

Anton Lembede Building

247 Burger Street

Pietermaritzburg

3200

Dear Dr Nzama

REQUEST FOR PERMISSION TO CONDUCT RESEARCH

I am a registered Master's student in the Department of Communication Science at the University of Zululand. My supervisors are Dr G.M. Naidoo and Prof H. Rugbeer.

The proposed topic of my research is *Innovative Communication Protocols for Teaching in Rural Secondary Schools*.

The objectives of the study are:

a) To examine the extent of communication technologies being used amongst teachers in rural secondary schools.

b) To determine the teachers' perceptions towards the use of new communication protocols for instruction within rural classrooms.

c) To investigate factors affecting the effective use of new communication protocols in rural secondary schools.

I am hereby seeking your consent to approach staff within the basic education sector to provide responses for this project. To assist you in reaching a decision, I have attached to this letter:

a) A copy of an ethical clearance certificate issued by the University
b) A copy the research instrument which I intend to use in my research

Should you require any further information, please do not hesitate to contact me or my supervisor. Our contact details are as follows:

Researcher: Minenhle Madida (083 990 3630) / msmadida@gmail.com

Supervisor: Dr G. M. Naidoo (035-9026164) / NaidooG@unizulu.ac.za

Co-supervisor: Professor H. Rugbeer (035-9026210) / RugbeerH@unizulu.ac.za

Upon completion of the study, I undertake to provide you with a copy of the dissertation.

Your permission to conduct this study will be greatly appreciated.

Yours sincerely,

_____

Minenhle Madida

Addendum 6: Ethical Clearance

UNIVERSITY OF ZULULAND
RESEARCH ETHICS COMMITTEE
(Reg No: UZREC 171110-030)

RESEARCH & INNOVATION
Website: http://www.unizulu.ac.za
Private Bag X1001
KwaDlangezwa 3886
Tel: 035 902 6731
Fax: 035 902 6222
Email: DlaminiA@unizulu.ac.za

ETHICAL CLEARANCE CERTIFICATE

Certificate Number	UZREC 171110-030 PGM 2018/506						
Project Title	INNOVATIVE COMMUNICATION PROTOCOLS FOR TEACHING IN RURAL SECONDARY SCHOOLS						
Principal Researcher/ Investigator	M Madida						
Supervisor and Co-supervisor	Dr GM Naidoo			Prof H Rugbeer			
Department	Communication Science						
Faculty	Arts						
Type of Risk	Med Risk- Data collection from people						
Nature of Project	Honours/4th Year		Master's	x	Doctoral		Departmental

The University of Zululand's Research Ethics Committee (UZREC) hereby gives ethical approval in respect of the undertakings contained in the above-mentioned project. The Researcher may therefore commence with data collection as from the date of this Certificate, using the certificate number indicated above.

Special conditions:

(1) This certificate is valid for 2 years from the date of issue.

(2) Principal researcher must provide an annual report to the UZREC in the prescribed format [due date- 17 August 2019]

(3) Principal researcher must submit a report at the end of project in respect of ethical compliance.

(4) The UZREC must be informed immediately of any material change in the conditions or undertakings mentioned in the documents that were presented to the meeting.

The UZREC wishes the researcher well in conducting research.

Professor Gideon De Wet
Chairperson: University Research Ethics Committee
Deputy Vice-Chancellor: Research & Innovation
17 August 2018

CHAIRPERSON
UNIVERSITY OF ZULULAND RESEARCH
ETHICS COMMITTEE (UZREC)
REG NO: UZREC 171110-30

2 0 -08- 2018

RESEARCH & INNOVATION OFFICE

143
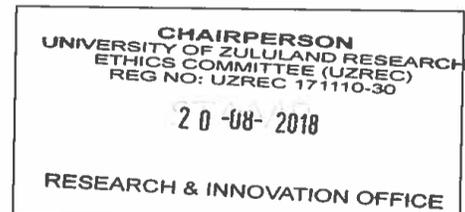
Addendum 7: Language Editing Certificate

STEVENS EDITING AND PROOFREADING

Charlotte Stevens*: BA (English; Industrial Psychology)*
Sole Trader
e-mail: **ajc.stevens@gmail.com**

Language Editor & Proofreader   **Membership:** *PEG (SA)*

THIS IS TO CERTIFY

That I have language edited a thesis titled *Innovative Communication Protocols for teaching in rural Secondary Schools* for Ms Minenhle Senzile Madida, Department of Communication Science, University of Zululand, South Africa: Email: msmadida@gmail.com; cell: +27 83 990 3630
The scope of my editing comprised:

> ➢ Spelling
> ➢ Tense
> ➢ Vocabulary
> ➢ Punctuation
> ➢ Word usage
> ➢ Language and sentence structure
> ➢ Checking of in-text referencing style

It was a good experience working with this student who communicated promptly when necessary, presented a well-written document and further proved her integrity by doing an immediate payment. My best wishes accompany her and I wish her good success in her studies and career.

Charlotte Stevens (Ms)
Stevens Editing and Proofreading
E: **ajc.stevens@gmail.com**
10 December 2018
(*Signature withheld for security purposes*)