IMPROVING LEARNER AND TEACHER PERFORMANCE THROUGH EFFECTIVE USE OF ICTs IN SOWETO SECONDARY SCHOOLS, GAUTENG PROVINCE

By

JOSHUA KUMBULA

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Supervisor: Prof. M. Lekhetho

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Student Number: 61925349

DECLARATION

I, Joshua Kumbula declare that "**Improving learner and Teacher performance through the effective use of ICTs in Soweto secondary schools, Gauteng Province**" is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

SIGNATURE DATE

19/12/2022

(Mr. Joshua Kumbula) ----------------------------

DEDICATION

This thesis is dedicated to my three lovely children: Tanaka John, Tendai Joyce and Tadiwanashe Joshua (Jnr) who had to endure doing their schoolwork without my guidance and assistance from me. My beloved wife, Annah Kumbula, who was very supportive and understanding during the entire journey of my studies.

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ABSTRACT

In South Africa, the Department of Basic Education (DBE) has invested a lot in the provision of computers in schools to empower teachers in the use of technology for pedagogical purposes. It ensures that there is access to Information and Communication Technology (ICT) resources for every learner. While this is commendable, the South African government underestimates the challenges associated with the provision of computers for teaching and learning in schools. These include teachers' negative attitudes towards the use of computers in the classroom, a lack of computer skills, and a lack of infrastructure. The government tries to mitigate these challenges through necessary support where possible. However, less attention is given to whether these computers are used effectively to enhance learners' academic performance and teachers' professional competence in schools. This is the gap that this study tried to fill.

The DBE's decision to provide computers to schools was triggered by the realisation that the integration of ICTs into teaching and learning is gaining momentum globally because they improve learners' technological competency, teachers' pedagogical proficiency and the country's development. In this context, this research explored how the effective use of ICT in Soweto secondary schools can improve learner and teacher performance. The study is underpinned by connectivism learning theory which is relevant for the digital age because it affords learners the ability to form connections with the information flow that takes place among network members. It adopted a mixed methods research approach by using both qualitative and quantitative research methodologies to gain better understanding of the research problem. Accordingly, semi-structured interviews were used to collect data from a purposefully selected sample of three teachers, one head of department (HOD) and one principal/deputy principal per school from each of the five selected schools. Altogether, 25 participants from five schools were interviewed. Ten teachers and 20 learners per school completed questionnaires, leading to a total of 150 respondents. Qualitative data was analysed thematically, while quantitative data was analysed statistically by means of Statistical Package for the Social Sciences (SPSS).

The research findings indicate that the use of ICTs in schools was only embraced by teachers and principals who understood their benefits, namely better methodological strategies, improved access to information, greater collaboration among teachers and the exposition of crucial learning platforms to learners. Despite these, many factors hinder effective use of ICTs in Soweto secondary schools. These include poor implementation of ICTs policies, inadequate

ICT infrastructure, teachers' lack of ICT skills, inadequate training, negative attitudes and poor teacher confidence, a lack of ICT leadership, and a lack of funds and technical support. To address these challenges, it is recommended that the Department of Education should support ICT policy implementation and use in schools, improve security in schools and clarify the role of principals, teachers and learners in ICT use.

Keywords: Connectivity, constructivism, Department of Education, information and communications technology, e-learning, teaching and learning, Soweto secondary schools,

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DEFINITION OF KEY CONCEPTS

Apartheid	A policy or system that was used in South Africa to segregate or discriminate on a group or race of people
Constitutional rights	Are rights whose protection from governmental interference is guaranteed by a constitution
Data	The quantities, characters or symbols on which operation are performed by a computer, which may be stored and transmitted in the form of electrical signals and recorded on magnetic, optical or mechanical recording media,
E-Learning	Electronic Learning
E-Schools networks	A group of computers or devices in schools that communicate with each other through an internet connection
ICT hardware	It is a generic term for any physical part of the computer system which you can physically touch, pick up or move
ICT software	The programmes and other operating information used by a computer
ICT Use	The use of different sets of technological tools and resources for communication, creation, dissemination, storage and management of information
M – Learning	Mobile Learning
Paradigm shift	It is an important change that happens when the usual way of Thinking about or doing something is replaced by a new and different way
Public Schools	Schools that are maintained using public funds for the education of children of a community or district and that constitutes a part of a system of free public education commonly including primary and secondary school
Racial segregation	The separation of humans into racial or other ethnic groups in daily life
Social networking	The use of dedicated websites and applications to interact with other users, or to find people with similar interests
Wi-Fi	A facility allowing computers, smartphones or other devices to connect to the internet or communicate wirelessly

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LIST OF ACRONYMS AND ABBREVIATIONS

C2005	Curriculum 2005
CAPS	Curriculum Assessment Policy Statement
CAT	Computer Application Technology
CAT	Curriculum and Technology
CAQDAS	Computer Assisted Qualitative Data Analysis Software
CD	Compact Disc
CEA	Centre for Evaluation Assessment
CMC	Computer mediated communication
CoL	Community of Learning
CPS	Cyber-Physical Systems
CSTS	Cyber Schools Technology Solutions
DBE	Department of Basic Education
DEEP	Digital Education Enhancement Programme
DfID	Department for International Development
DHET	Department of Higher Education and Training
DoE	Department of Education
DNP	Draft National Policy
DVD	Digital Versatile Disc
EA	East Africa
EAC	East African Community
EFA	Education for all
ELRC	Education Labour Relations Council
EMIS	Education Information Management Programme
FET	Further Education and Training band
FRSS	Fast Response Survey System
GDE	Gauteng Department of Education
GET	General Education and Training band
HOD	Head of Department
HSRC	Human Science Research Council
ICDL	International Computer Driving Licence
ICT	Information communication technologies
IEA	International Association for the Evaluation Achievement

IQ	Intelligent Quotient
IT	Information Technology
ISPA	Internet Service Providers' Association
MDG	Millennium Development Goals
MEC	Member of the Executive Council
MoE	Kenya Ministry of Education
MoES	Uganda Ministry of Education and Sport
MoEST	Kenya Ministry of Education, Science and Technology
MoEVT	Tanzania Ministry of Education and Vocational Training
MoW	Uganda Ministry of Works
NCES	National Centre for Education Statistics
NDP	National Development Plan
NEPAD	New Partnership for Africa's Development
NGOs	Non-governmental Organisations
NICI	National Information and Infrastructure
NICIPD	National Information Communications Infrastructure Policy and Plan
OBE	Outcomes-Based Education
PLC	Programmable Logic Controllers
PDOEs	Provincial Department of Education
PPP	Public-Private Partnership
QDA	Qualitative Data Analysis
REC	Research Ethics Committee
RNCS	Revised National Curriculum Statement
SA	South Africa
SACE	South African Council for Educators
SA-SAMS	South African School Administration and Management System
SAITIS	South African Information Technology Industry Strategy
SITES	Second Information Technology in Education Study
SMT	School Management Team
SPSS	Statistical Package for Social Sciences
SSA	Statistics South Africa
TIMMS	Third international Mathematics and Science Study

TLI	Teacher Laptop Initiative
TPD	Teacher Professional Development
TV	Television
UNCST	Uganda National Council of Science and Technology
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNISA	University of South Africa
USA	United States of America
VfR	Vision for Rwanda
ZPD	Zone of Proximal development

CHAPTER 1

INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

The twenty-first century demands a significant shift in how knowledge is disseminated throughout the world including South Africa. This has led to the introduction of e-learning programmes into the education system of many countries. The surge in Information and Communication Technologies (ICTs) worldwide has greatly transformed the workplace and education systems in many countries. This has prompted many countries throughout the world to ensure that there is equity and inclusion in education through the use of ICTs (Cha, Park & Seo, 2020:2967). ICT refers to various sets of tools and resources that are used to communicate, create, disseminate, store and manage information (UNESCO, 2008:11). Computers, broadcasting technologies, the internet and telephony are technological tools that are used to communicate, create, disseminate, store and manage information. In the education sector, the use of these tools helps teachers to be tactical and organised in employing innovative strategies that enhance teaching and learning in the classroom. However, a paradigm shift brought about by the integration of ICTs in education means that the world should be prepared to meet new issues and challenges, and acquire innovative methods, skills and knowledge to adequately manage the use of technology.

In South Africa, Mdlongwa (2012:4) acknowledged that ICT introduction in schools usually comes with major challenges. The Gauteng Department of Education (GDE) (2019:208) affirms that the transformation brought by ICTs demands new perspectives on teacher training to make sure that teachers adapt easily to the new digital world. However, some schools, especially those in disadvantaged communities face several challenges like teachers' resistance to ICT-based methods of teaching because of their fear of change and inability to use technologies. Vandeyar (2015:348) agrees that the challenges that South African schools face are due to a lack of resources and qualified teachers. As Karunaratne, Peiris and Hansson (2018:118) argue, a lack of resources in schools can hinder the use of ICT use in some classrooms. The challenges faced by these schools make it impossible for learners to realise the potential associated with the use of ICTs in improving both teaching and learning outcomes. Rabah (2015:24) affirms that ICT integration can only be successful if the school context, setting and environment have been taken into consideration. This is important because some of the challenges that schools encounter in the process of integrating technology in their teaching and learning are context-specific. It is unfortunate that there are still challenges that hinder the government’s efforts to achieve equity in ICT use in schools. For this reason, schools in disadvantaged communities are mostly affected and continue to lag behind in terms of ICT resources (Mirzajani, Mahmud, Ayub & Wong, 2016: 26). Furthermore, Mirzajani et al. (2016: 26) argue that a lack of ICT resources in schools discourages teachers from integrating ICTs in the classroom.

Despite all the challenges mentioned above, Steyn and Van Greunen (2014:241) argue that when ICTs are used for pedagogical purposes, they have the potential to transform teaching and learning positively in schools. Marcovitz (2015:3) observes that the introduction of ICTs in the classroom has intensified changes in pedagogy. Pedagogy refers to various teaching practices that aim to improve students’ cognitive abilities (Marcovitz, 2015:3). In South Africa, the DBE has invested a lot in the provision of computers in schools to empower teachers in the use of technology for pedagogical purposes (Graham, Stols & Kapp, 2020). In 2015, more than 300 schools in Gauteng received laptops to be used for educational purposes. Despite this lofty initiative by the DBE, there are still some barriers like teachers’ negative attitudes, lack of skills and beliefs regarding the implementation of ICTs that derail the DBE’s efforts (Bladergroen & Buckeley, 2016: 37; Kalogiannakis & Papadakis, 2019). Therefore, the DBE must not only concentrate on ICT integration but also change teachers’ attitudes towards the use of ICTs in the classroom. Ultimately, the DBE must ascertain whether the introduction of ICTs in schools helps to improve teacher and learner performance, which is the focus of this study. The study focused on five purposively selected secondary schools in Soweto in disadvantaged communities with the aim of establishing whether ICTs were used effectively to improve learners and teachers’ performance. Khan (2020:23) contends that the use of ICTs in teaching and learning can potentially improve learner achievements, especially in areas with low socioeconomic status.

1.2 BACKGROUND TO THE STUDY

In one of his speeches, the former Secretary General of the United Nations, Mr. Kofi Annan reiterated that the new technologies that are taking over and changing our world would not magically solve all our problems (UNESCO, 2002:14). However, he acknowledged that these new technologies can be viewed as enormous and powerful tools for development. He further enunciated that some of the significant changes that these technologies can bring are job creation, transformation of the education sector, health care, commerce, accountable governance and an effective political system. He also noted that one of the biggest challenges that different nations face in the twenty-first century is making sure that everybody can harness the extraordinary force of technology and spread it throughout the world (UNESCO, 2002:14-15). When this happens, then the benefits can be accessible and meaningful for all humanity, particularly in poor countries (UNESCO, 2002:14-15).

Kofi Annan's words, referred to above, confirm that the emergence of computers in the late twentieth century, together with other technologies in the twenty-first century have impacted greatly on humankind. Computers and their associated technologies have contributed to the way people communicate and do business. This includes manufacturing, engineering, finances, medicine, agriculture and other fields. This transformation has also led to the Information (or Knowledge) Age, which the National School Board Association in Hess (2002:156) in the US, described as a perpetual change. Contrary to the previous transformation during the industrial age, the Knowledge Age transformation is change that is followed by instability in the sense that it is very fast and continuous (UNESCO, 2008:11). This technological change is continuously evolving and impacts every individual and the entire society. The changes can only be managed if schools in South Africa do not produce school-leavers who are ill-equipped to operate effectively and efficiently in the digital world (Retief, 2019:1).

The information age saw most governments around the world moving away from the traditional methods of teaching and learning in their education systems. Instead, they adopted new teaching methods that are aligned with the use of ICTs. This demands the world to be prepared to meet new challenges, develop innovative thinking, acquire necessary skills and knowledge, and demonstrate the ability to use technology effectively. Countries also need increased funding to invest in ICT resources and infrastructure (Kayembe & Nel, 2019:79). The change that is brought by the introduction of ICTs is powerful and must not be taken lightly since it demands new perspectives when it comes to teacher development (Mihaescu & Andron, 2019:10). Sikhakhane, Govender and Maphalala (2021:6) and Mdlongwa (2012:4) collectively agree that there are unprecedented challenges associated with the introduction of ICTs in schools. These could include teachers' resistance to ICT-based teaching methods, the inability to cope with new technologies and the fear of change.

Comparatively speaking, South Africa is one of the most developed countries in Africa with a stable economy and government. Mjwara (2017:1) claimed that, for almost two decades, South Africa has been tirelessly making efforts towards achieving a paperless classroom with the aim of providing better learning opportunities and better learning environments for learners. The South African government believes that ICTs can change how learners learn (Mjwara, 2017:1). Cognisant of all the advantages of ICT in learning, in 2003, the Department of Education committed to make sure that access to ICT resources for every learner in South Africa was a reality by the year 2013 (DoE, 2003:17). This commitment by the government paved the way for multiple engagements across the board to achieve ICT integration in all schools across South Africa (Odendaal, 2017:2). Through its provincial Department of Education, Gauteng was one of the provinces that embraced and endorsed ICT integration following the government's commitment to ICTs. It embraced ICTs with passion by providing ICT tools to learners with the hope of making learning simpler and more exciting for learners (Odendaal, 2017:20). By introducing ICTs in the classroom, the GDE believed that the negativity towards the South African education and poor performance of learners in mathematics and science would eventually end (Rabana & Martin, 2017:24). Zakaria and Khalid (2016:1537) concur that ICTs can motivate and grab learners' attention in the classroom. Le Thi (2020:46) echoes these sentiments by saying that ICTs provide authentic learning environments which allow learners to engage in web-based inquiry.

Although many schools have ICTs, they do not use them effectively, and this prompted the researcher to conduct this study, focusing on how learners and teachers' performance can be improved through effective use of ICTs in secondary schools of Soweto. It is believed that township schools do not use ICTs effectively as half of the computers are often not used due to the unavailability software (Mlitwa & Karateng, 2013:1; Tire & Mlitwa, 2008:15). The schools selected for this study already had the infrastructure in place. The research sought to find out whether these ICTs were used effectively to improve teacher and learner performance.

The South African government is aware of the benefits of ICTs and that they are the building blocks for society. It fully appreciates that ICTs can play a pivotal role in enhancing the schooling system. In 2014, there was a roll out of computers to Gauteng public schools. Each school was provided with 40 tablet computers through the e-learning solutions project (DBE, 2014: 2013). The aim was to help learners to access learning material digitally. Furthermore, they wanted teachers to create a teaching culture that incorporates e-learning as a tool for enhancing both teaching and learning (GDE, 2007:18; Makhura, 2015:15). The provision of tablets to schools was in line with the Gauteng government's vision and mission aimed at building a smart knowledge-based and innovative-driven economy in the province (Makhura, 2015:15). It was important for the GDE to take such bold steps to redress the historical inequities caused by the apartheid regime. Moreover, the DBE stressed how important it was to integrate ICTs in teaching and learning. DBE (2014:7) stressed the importance of integrating ICTs in teaching and learning. This was triggered by South African learners' dismal performance in the 2011 Third International Mathematics and Science Study (TIMMS) tests (HSRC, 2012:4).

Despite the notable efforts by the national and provincial departments of education to integrate ICT in education, it appears that many schools still have challenges when it comes to implementation, which renders the process ineffective and inefficient. For Bladergroen, Chigona, Cox, Dumas and Van Zyl (2012:115), the main obstacle to this implementation is the unavailability of adequate technological resources to be used in schools and unsuccessful integration of ICTs in the teaching and learning process. These authors conceded that, although teachers are open to the integration of ICTs into their teaching, many of them still resent using them for teaching and learning. In addition, Van Wyk (2014:4) concluded that most ICTs in schools are either under-utilised or not used at all. Ford and Botha (2014:4) concurred that only 2% of computer laboratories in well-resourced South African public schools are actively used. Previous research has established that there is a huge gap between urban schools and township schools in terms of ICT impact on teaching and learning (HSRC, 2012:4). Against this background, the researcher undertook this study in Soweto secondary schools to determine the effectiveness of ICTs in enhancing learner and teacher performance.

1.3 RATIONALE FOR THE STUDY

The South African education institutions in general, and schools in particular, are set to grow significantly in ICT access, teacher training, professional development and use (Global Human Rights Clinic [GHRC], 2020:30). However, there are still major challenges such as a lack of a comprehensive ICT policy on education that covers all educational institutions and ensures that they benefit from the effective and efficient use of technologies in teaching and learning. Above all, South Africa needs to demonstrate the value of investing in ICTs through improved performance of learners and teachers and improved employability of learners in the changing labour market (Fu, 2013:112).

Although considerable research on e-learning has been conducted in African countries and developing countries, very little has been conducted on the effective use of ICTs and how they can improve learner and teacher performance in South African secondary schools (GHRC, 2020:19). Most ICT research in education has evolved around and is embedded within the national government vision and is expressed as a social and development strategy (Isaacs, 2007:8). The focus has been on ICT policies, policy implementation, current ICT initiatives and projects in schools, technology access programmes, and e-Schools networks (GHRC, 2020:15). In general, the focus has been on ICT provision and not necessarily on how the learners and teachers' performance could be improved through ICTs, especially in Soweto public secondary schools. Soweto public secondary schools were chosen for this study because they are still regarded as the epitome of racial segregation since Soweto was an area for blacks only during apartheid (Isaacs, 2007:3). South African schools today can be described as a melting pot of diversity because the education sector went through several reforms over time (DBE, 2011: 48). The reforms were initiated by the new South African government to do away with the apartheid education system which favoured whites and discriminated against blacks (Munje & Jita, 2020:264). In 1994, the new democratic government inherited 17 racially differentiated departments of education and bureaucracies from the apartheid government primarily distinguished by huge disparities in the resources allocated to them (Fleish, 2002:2). Before 1994, the education system was designed to benefit the white race group at the expense of the black majority and other groups. After 1994, when the new democratic government was elected, it progressively laid the foundations on which racial inequality, segregation and a fragmented schooling system gave way to a uniform system aimed at making the constitutional right to education a reality for all (Barry, 2006:7).

Even though South Africa has made considerable progress in the use of ICTs, many township schools are still lagging in many aspects (Isaacs, 2007:9). One of the aspects is the provision of ICT education that focuses on effective and efficient use of ICTs to promote learner and teacher performance. The introduction of e-learning in township public secondary schools necessitated changes to the curriculum, infrastructure, teacher professional development, textbooks and examinations. Thus, it is imperative that township public secondary schools should be properly prepared for all these changes if the introduction of e-learning into the education system is to succeed. Govender and Juggernath (2020) concur that the emergence of Fourth Industrial Revolution (4IR) and the significant growth of artificial intelligence demands that all educators become digitally proficient in ICTs. The study, therefore, proposes that

Gauteng township secondary schools should embark on more vigorous in-service training for teachers to equip them with the necessary ICT skills. Proper training of teachers on the implementation of the new e-learning curriculum and suitable infrastructure is necessary for successful integration in education.

The information obtained from this study could be pave the way for better planning and monitoring quality of e-learning programmes in Gauteng township secondary schools. Based on the research findings, proposals are made for further studies on how e-learning programmes in future could be implemented effectively in Gauteng township public schools to improve learner and teacher performance. This study focuses on the importance of engaging learners and teachers in effective use of ICTs in the teaching and learning process in Soweto secondary schools. It also focuses on how ICTs can positively contribute to improved learner achievement. It probes the effectiveness of e-learning policies in guiding teachers to teach competently. Furthermore, through this study, policymakers, education managers and teachers could develop a better understanding of how e-learning could be used in the classroom to improve learners and teachers' performance in future. The findings could also help schools and the DBE to develop appropriate ICT teacher development programmes that could benefit public secondary teachers. Ultimately, the findings of the study could identify effective ways in which the ICTs can be used to improve learner and teacher performance in Soweto secondary schools.

1.4 STATEMENT OF THE PROBLEM

The changes that have occurred in the delivery of instruction through technology have shown a growing emphasis on the integration of technology in curriculum (Hargrave & Hsu 2010:1). As Massey (2009:78) observes: "it is the promise and anticipation of what technology can do in the future that is now affecting attitudes and ideas about how we can teach and learn". However, the mere introduction of technology in schools without ensuring that it is used effectively defeats the purpose. There is a need to explore effective integration of technology, better methods of teaching and how teachers can better add and use content (Meyer & Gent, 2016:2).

From the literature reviewed, very little looked at how ICTs can improve learner and teacher performance. While other countries have ICT implementation rate of over 41% in secondary schools, the percentage in African countries including South Africa remains very small (ICASA, 2021:6). Accordingly, most schools in Africa do not benefit from ICT programmes such as record keeping, research, financial analysis, examinations, supervision, general school management functions and other learner-focused study programmes.

Literature has also revealed that ICTs can only be successfully implemented in schools when there is access to good and reliable electricity supply (ICASA, 2021:6). They should also be equipped with relevant and secure infrastructure like buildings, retrofitted physical facilities, good connectivity and appropriate ICT hardware and software. The human aspect is also very important and includes professional development of teachers through intensive in-service courses (Munje & Jita, 2020:266). Therefore, providing technology just for the sake of it would not have any lasting impact on education. Instead, Meyer and Gent (2016:3) submit that technology must support educational processes to have the desired effect and not work against effective functioning of schools, teaching and learning and lower educational outcomes. They further argued that technology in teaching must be instrumental in defining clear educational objectives.

The introduction of ICTs in schools should ensure that teachers and learners benefit meaningfully in the teaching and learning process. Although statistics provided by the DBE indicate that the integration of ICTs in schools is progressing very well (Munje & Jita, 2020:265), the question that should be asked is whether most learners and teachers in Soweto secondary schools benefit or improve their productivity and academic performance significantly from the use of ICTs. Therefore, to establish whether ICTs benefit learners and teachers in schools, the researcher carried out this research to ascertain whether they are used effectively to improve learner and teacher performance in Soweto secondary schools.

1.4.1 Research Questions

The main research question that this study sought to answer is framed as follows:

How best can the Department of Basic Education promote effective use of ICTs or e-learning programmes to improve the performance of learners and teachers in Soweto public secondary schools?

1.4.1.1 Sub-questions

To address the main research questions comprehensively, the following subsidiary questions are posed:

a) How effective is the use of ICTs in improving learner and teacher performance in public secondary schools of Soweto?

b) How can the Gauteng Department of Education promote effective use of ICTs to improve the performance of learners and teachers in public secondary schools of Soweto?

c) What can Soweto secondary schools do to promote effective use of ICTs to improve learner and teacher performance?

d) How do learners and teachers in Soweto secondary schools overcome the challenges involved in the implementation of e-learning?

e) What role do teachers in Soweto secondary schools play in promoting effective use of ICTs to improve learner and teacher performance?

1.4.2 Aim of the Study

The aim of this study was to explore how best the Gauteng Department of Education can promote effective use of ICTs to improve learner and teacher performance in Soweto public secondary schools.

1.4.2.1 Objectives

a) To determine how effective, the use of ICTs is in improving learner and teacher performance in Soweto public secondary schools.

b) To explore how the Gauteng Department of Education can promote effective use of ICTs to improve learner and teacher performance in Soweto secondary schools.

c) To determine what secondary schools of Soweto can do to promote effective use of ICTs to improve learner and teacher performance.

d) To analyse how learners and teachers in Soweto secondary schools overcome and manage the challenges in the implementation of e-learning.

e) To assess the role that teachers in Soweto secondary schools play to promote effective use of ICTs with the aim of improving learner performance.

1.5 THEORETICAL FRAMEWORK

This study is underpinned by connectivism learning theory which stipulates that learning can take place anywhere through different channels and not necessarily only in the classroom (Siemens, 2004:4). This theory is appropriate for the study as it gives a better understanding of how ICTs are integrated and used for teaching and learning purposes in schools. The theory also helps to shed light on the teachers' perceptions of ICT integration in the classroom. Connectivism theory clarifies how learning and teaching unfold in the digital age, and how learners and teachers can learn and share knowledge and information through social networks (Bartolome & Steffens, 2015:96). The theory is discussed in depth in Chapter 2.

1.6 PRELIMINARY LITERATURE REVIEW

The introduction of ICTs or e-learning, globalisation and new knowledge economy has brought about changes in the education system (Munje & Jita, 2020:263). These changes have impacted teaching and learning and spurred education transformation systems. E-learning is defined as the amalgamation of modern technology in the classroom which can sometimes involve learning that does not require mediation (Moore, Dickson-Deane & Galyen, 2010:130; Ouma, Awouor & Kyambo, 2013:1). It is also described as a computer-based educational system that incorporates both formal and non-formal learning across all levels. For the delivery of content, the interaction between learners and teachers, and between learners and content, e-learning depends on the local network, the intranet or extranet (Epignosis, 2014:5; Moore, Dickson-Deane & Galyen, 2010:130). The common thread in the two definitions above is that e-learning involves online learning, computer-aided instruction or learning and web-based learning and training. Increasingly, many schools in the world have introduced e-learning systems to provide learners with online access to learning content. The main driving force for this new phenomenon is the changing demographic factors of learners, the changing conditions of education delivery and the innovation in technology itself (Concannon, Flynn & Campbell, 2005:509).

The introduction of technology has made it possible and necessary for learning to occur very quickly. The information age has necessitated curriculum change and renewal that make it relevant to learners' lives. It also seeks to address the learners' needs and to provide them with the required skills and knowledge to function in the real world using technology (Vandeyar, 2015:344). Schools are now obliged to use a constructivist pedagogical approach to learning mediated through ICTs. The use of constructivist approaches mediated through ICTs affords learners the opportunity to set their own goals, plan their own activities and monitor their own levels of mastery and understanding of the learning material. Therefore, the new information age also demands that learners become active participants in their learning activities rather than passive receivers of information from teachers (Padayachee, 2017:37).

Fu (2013:117) argued that the availability of ICT on its own is not enough to transform teaching and learning. There is a need for the teacher to actively participate in the use of ICTs in the classroom. Therefore, the success or failure of ICT use in the classroom is directly related to the amount of teacher involvement in the implementation process (Fu, 2013:117). In other words, it is the teachers' responsibility to make sure that they follow the correct principles and techniques of various learning theories. They should also choose relevant ICTs which can facilitate learners' understanding and enhance learning and teaching. According to Begg (2015:70), there are several ICT-related learning theories that can be used effectively to enhance teaching and learning in schools such as behaviourism, constructivism and connectivism. Begg (2015:70) further defined a learning theory as a logical framework of how we come to know about learning. Altuna and Lareki (2015:2) argue that behaviourism, constructivism and connectivism are learning theories that can be applied in different learning situations focusing on individual learners' different learning potential and styles. These learning theories are important since they are universal and able to embrace different learning styles of learners. The theories are designed to benefit all learners as they create challenging instructional environments. Most importantly, these theories can incorporate and justify the use of ICTs in the teaching and learning process. The three theories have certain principles and techniques that guide teachers with instructional strategies and principles to employ when teaching learners. Simultaneously, the theories give guidance on what behaviours learners should be able to do to demonstrate when learning has taken place. In this study, the three theories are explored as they impact on teaching and learning in the ICT-integrated learning situation (Altuna & Lareki, 2015:2).

All the transformations caused by ICTs are significant as they enable teachers and learners to acquire skills and knowledge deemed relevant in the information age (Meyer & Gent, 2016:3). Realising the impact that ICTs have on teaching and learning, nations around the world have made it a priority to ensure that they are successfully integrated into the classroom (Munje & Jita, 2020:263). Khan (2020:26) contends that the use of ICTs in the classroom has the potential to improve learner achievement and participation in their schoolwork. However, because of the dynamics associated with the integration of ICTs in the classroom, many countries have different views on how to carry out the integration properly (Rabah, 2015:24). One of the essential factors to consider in the integration is the school's context and environment. Rabah (2015:24) postulated that viewing ICT-based education without taking into consideration the context and environment of the school is a futile exercise that can have serious implications for ICT integration. For Karunaratne, Peiris and Hansson (2018:118), one of the potential contextual factors that hinders the use of ICTs in the classroom is a lack of resources. Mirzajani, Mahmud, Ayub and Wong (2016:26) argue that one of the dangers of a lack of resources in schools is that teachers are likely to be discouraged to integrate ICTs in the classroom.

In South Africa, various role players have taken part in the introduction of ICTs (Meyer & Gent, 2016:2). The role players include non-governmental organisations (NGOs), provincial and national departments of education and solution providers to research institutions (Meyer & Gent, 2016:2). However, there are still challenges that inhibit the DBE from achieving equity when it comes to ICT integration, especially in disadvantaged communities. The challenges include poor infrastructure, a lack of funding, poor connectivity, inadequate ICT equipment, a lack of teacher skills and erratic electricity supply (Mirzajani et al., 2016:26). The DBE concedes that a lack of funding hinders their efforts in the implementation of their ICT-Integrated Plan (Parliament of the Republic of South Africa, 2018:23). Garg, Shukla and Kendall (2015:4) concur that the implementation of any ICT-integration plan can be derailed by a lack of funds. For this reason, about 11 858 primary schools did not have computer laboratories and up to 9 313 secondary schools were without internet connectivity across South Africa by July 2018 (Parliament of the Republic of South Africa, 2018). From these figures, it is obvious that despite the efforts of the DBE to make sure that they integrate technology successfully in schools, many children still do not benefit from this initiative (Munje & Jita, 2020:266). Despite the DBE's desire to improve education through the provision of ICTs in schools, the pace of integration in some schools is very slow due to different contextual factors (Kwet, 2017:8054).

When the DBE noticed that the pace of its ICT implementation plan was slow, it introduced what it called "Operation Phakisa" [Phakisa is a Sesotho word which means hurry up] (Kwet, 2017:8054). It did this to fast-track and monitor its implementation of ICTs across the country. By introducing the Operation Phakisa, DBE sought to ensure that they increased the pace of the identification of the challenges hindering the provision of relevant ICT equipment, especially in under-resourced schools (Kwet, 2017:8054). In spite of all the DBE's efforts to step up ICT provision in schools, some schools are still under-resourced, and it is still to be seen if there can be any tangible evidence of some improvement in future (Chisango & Lesame, 2017:48). As Pholotho and Mtsweni (2016:1) point out, poor service delivery is one of the main reasons why some schools in Limpopo have not yet benefited adequately from the government's ICT-integration initiative. Ismail, Jogezai and Baloch (2020:1537) conceded that these challenges are common in developing countries.

Furthermore, Mirzajani et al. (2016:26) point out that the challenges related to insufficient technical support when it comes to ICT integration in the classroom is not only a South African a problem, but rather a common phenomenon in most developing countries. However, they maintain that if schools and administration work closely together to identify the challenges and provide advice, these could be resolved. Pholotho and Mtsweni (2016:2) concur that strong technical support can go a long way in ensuring stable internet connectivity and the prevention of computer facilities under-utilisation by schools. Arrieta (2020:95) agrees that internet connectivity is an ongoing challenge even beyond the borders of South Africa. Therefore, these contextual challenges need to be addressed decisively in South Africa because if they are left unresolved, ICT-integration agenda would remain a dream (Padayachee, 2017:37). For this reason, the DBE has a massive responsibility to carry out regular audits of the technological wellbeing of individual schools to monitor problems encountered and progress made (Munje & Jita, 2020:267).

1.7 RESEARCH METHODOLOGY AND DESIGN

1.7.1 Research Approach

This study adopted mixed methods research that uses both qualitative and quantitative research methodologies and a multiple case-study design. A multiple case study is detailed an investigation of phenomena which could include institutions, communities or professions (Gilham, 2010:1). This study focused on five cases, namely township secondary schools in Soweto. A case study can be a very powerful tool to use to investigate a phenomenon due to its singular nature which allows the researcher to focus on the complexity of a case (May, 2011:122). Using a case study for this research was important since it afforded the researcher an opportunity to explore whether effective use of ICTs enhanced learner and teacher performance in each school and in its unique environment (May, 2011:122). The investigation covers learner skills in ICT, teacher skills in ICT, availability of ICT equipment and infrastructure in schools, ICT use, connectivity, ICT policy issues and ICT teaching and learning processes in schools to address the research question.

In-depth face-to-face interviews were conducted to collect qualitative data and questionnaires were used to collect quantitative data. The mixed methods approach was used to prevent biases that could result from using a single methodology (Babbie & Mouton, 2010:275). Furthermore, Babbie and Mouton (2010:275) postulate that combining the two methodologies helps the researcher acquire more knowledge from the participants and overcome the shortcomings that flow from one method. The mixed methods approach increases the reliability of the findings since it combines data collected through both face-to-face interviews and questionnaires (Creswell & Plano Clark, 2011:6). The quantitative methodology used in this study was informed by the positivist paradigm while the qualitative methodology was based on the interpretivist paradigm. According to positivism, it is imperative for humans to be studied in the same way nature is studied since scientific knowledge is regarded as facts and reality and to be independent from social construction. The positivists believe that the world is a fixed entity whose mysteries are not beyond human comprehension (Schumacher, 2010:15). For this reason, their research methods and findings are usually quantitative, statistically significant and generalised (Schumacher, 2010:15). On the contrary, interpretivism as an approach focuses on understanding individuals and how they understand their world and develop subjective meanings of their experiences (Schumacher, 2010:15).

1.7.2 Pilot study

For the pilot study, which is a small-scale version of the proposed study, with a limited sample of subjects (Mason & Bramble, 1997:84), the researcher handed out questionnaires to one school in the vicinity of the study which did not form part of the sample. The researcher used the feedback from the pilot study to rectify any unclear statements, inconsistencies and repetitions and refine the final data collection instruments (White, 2005:256).

Table 1.1: Pilot study sample

Participants	School 1	School 2	School 3
Principals/deputy principal (Interviews)	1	1	1
HoDs (Interviews)	1	1	1
Teachers (Interviews)	3	3	3
Learner Focus Groups (interviews)	1	1	1
Learners (questionnaires)	10	10	10
Teachers (questionnaires)	5	5	5

1.7.3 Population and Sampling

1.7.3.1 Population

A population refers to a group of individuals or a selection of objects, events or individuals with similar or common characteristics that the researcher has interest in the study (Saunders, Lewis & Thornhill 2012: 680). Furthermore, Mouton (1998:86) describes population as the total of all the cases deemed to meet the definition of unit analysis by the researcher. For Babbie (2010:199) and McMillan and Schumacher (2010:129), a population comprises of a group of elements, cases or individuals that adapt to the researcher's criteria which help the researcher to generalise the findings of the research. The research population for this study comprised all secondary schools, teachers, principals and learners that used ICTs for teaching and learning in Soweto, Johannesburg West.

1.7.3.2 Sample

Gentles, Charles, Ploeng and McKibbon (2015:1772) describe sampling as a selection of specific data sources from which data are collected to address the research objectives. The research sample size for this study was five secondary schools, which constituted a multiple case study from which the researcher collected the relevant data. The data collected was on the promotion of effective and efficient use of ICTs to improve learner and teacher performance in Soweto secondary schools. This was done to answer the main research question and subsidiary questions. Selected schools were those with computer laboratories and computer tablets. The sample also involved the selection of participants within schools. This is described in detail in Chapter 4. The sampling process is described separately below. A breakdown of different respondent groups is presented in Table 1.2.

Table 1.2: Proposed study samples per group

Respondent group	**Instrument**	**Number of schools**	**Number per school**	**Total**
Principals	Interview	5	1	5
HODs	Interview	5	1	5
Teachers	Interview	5	3	15
Teachers	Questionnaire	5	10	50
Grade 11 Learners	Questionnaire	5	20	100
Total		**5**	**35**	**175**

1.7.4 Instrumentation and Data Collection

Qualitative data was generated through interviews with selected teachers, HoDs, principals and Grade 11 learners. The interviews were deemed appropriate because they allowed the researcher to access the participants' constructed realities and interpretations of their own experiences (Fontana & Frey, 2000:645). In-depth interviews enabled the researcher to understand the perspectives of participants regarding their experiences or situations by using repeated face-to-face encounters (Denscombe, 2009:141). During the interviews, the researcher recorded participants' responses and transcribed them. The recordings helped the researcher recall all that was said in the interviews by the participants.

1.7.4.1 Questionnaires

The questionnaires were distributed to learners and teachers in the five schools selected for the purpose of this study. The information gained from the literature study regarding the research topic was used to develop and design the questionnaires, which were divided into two units. Unit A of the questionnaires dealt with the biographical data while Unit B focused on the practical aspects of participants` experiences regarding the subject being investigated (White, 2005:255). The researcher hand delivered questionnaires together with the cover letter explaining the aim of the focus and significance of the study to the participants. The cover letter also gave instructions on how participants should complete the questionnaire. The researcher also assured the participants of the anonymity and confidentiality of their responses.

1.7.5 Data Analysis and Interpretation

Data analysis entails bringing order, structure and meaning to the mass of information and how the phenomena interconnect with the researcher's concepts (Leedy & Ormrod, 2015:278). In this study, thematic analysis was used to summarise what was seen and heard in terms of common words, phrases, themes or patterns (McMillan & Schumacher, 2010:370). This was done to assist with the understanding and interpreting of the phenomenon under investigation and drawing conclusions. Data was coded to identify emerging themes, sub-themes, patterns and categories. Saldaña (2016:11) describe coding as a process where meaningful analytic units of data are unveiled through transcriptions. Data analysis was done for the qualitative and quantitative strands of the mixed methods study.

1.8 RESEARCH ETHICS

Research ethics deals with the measures and principles which the researcher should bind himself with (Lynn and Powell, 2010: 68). In this study, the researcher adhered to the following ethical principles: permission to conduct research, informed consent, confidentiality and anonymity and dissemination of research findings.

1.8.1 Permission to Conduct Research

As McMillan and Schumacher (1993:195) proposed, the researcher sought ethical clearance to conduct research from the Research Ethics Committee of the University of South Africa before data collection could commence (Appendix A). Subsequently, he wrote a letter to the GDE head office seeking permission to conduct the study in the district offices and schools in Johannesburg (Appendix B). The researcher also sought permission from the selected institutions before data collection could commence (Appendix C). Lastly, the participants were given adequate information about the study before data could be collected (Appendix F, G, H, I, J).

1.8.2 Informed Consent

All the participants were informed about the purpose of the research procedures to be followed, possible benefits and risks for the participants and how the results would be used (Schulze, 2002:17). This was important as it helped participants to decide whether they wanted to participate in the study or not. Participants were also made aware of their rights to withdraw from the study at any point without suffering any repercussions. The researcher did not use any form of deception to enforce the participation of the participants (De Vos, 1998:27).

1.8.3 Confidentiality and Anonymity

Confidentiality is concerned with the steps taken to protect those who participated in the research, if necessary (Flick, 2015:32). A researcher must always be responsible, mindful, sensitive and vigilant to make sure human dignity is maintained (Gay, 1996:85). McMillan and Schumacher (1997:195) concurred that participants' information should always be kept confidential unless agreed on through informed consent. In this study, the researcher, participants' confidentiality was not compromised at all. The researcher did not any time divulge any private or secret information of participants making sure their right to confidentiality was respected (Flick, 2015: 32). The researcher was the only person, together with the supervisor, who had access to the data. To ensure anonymity of participants and confidentiality of the information they provided, the research findings are presented anonymously, and pseudonyms are used to conceal their identities.

1.8.4 Dissemination of research findings

As a gesture of the researcher`s gratitude toward their participation, participants should be informed of the findings of the study (Schulze, 2002:19). As part of disseminating research findings, once this study has been finalised, all participants will be provided with a summary of findings and recommendations or short presentations if they accept. A University of South Africa (UNISA) online library link will also be shared with them where they can access the whole thesis.

1.9 DELIMITATIONS AND LIMITATIONS OF THE STUDY

1.9.1 Delimitations of the Study

According to Simon (2011:12), the characteristics that limit the scope while defining the boundaries of the study are called delimitations. This research involved five public secondary schools in Soweto under the jurisdiction of Johannesburg Central District. The interviews were conducted with 15 teachers, five heads of department (HoDs), 20 learners and five principals from each of the five selected public secondary schools. Since the research sample was small and the schools were from the same township, the findings are not generalised. The main goal was to provide a rich, contextualised understanding of the effectiveness and efficiency of ICTs in improving learner and teacher performance in selected schools. Although the findings of the study are not generalisable, they can be extended to other South African township schools that use ICTs for teaching and learning purposes. Although the study mentioned factors that inhibit or enhance the adoption of e-learning in townships, the focus was on how effective and efficient these ICTs were in improving learner and teacher performance in the schools under study.

1.9.2 Limitations of the Study

The interviews for this study were consciously carried out during the first and third terms when schools were not involved in examinations. However, the time proved insufficient for research of this magnitude, particularly in the wake of the COVID-19 pandemic that restricted normal movement because of rolling lockdowns in South Africa. The interviews were very hard to conduct due to the lockdowns and restrictions that were imposed by the government to curb the spread of the virus. Therefore, the limitations of this study were mainly a lack of time and access to schools. Consequently, the data obtained was only a fraction of many things that occur in these schools regarding the use of ICTs. Simon (2011:12) expressed similar sentiments regarding time, namely that a study done over a short period of time is only a snapshot that depends on conditions that occur at that time.

1.10 CHAPTER OUTLINE

The study is demarcated into the following six chapters:

Chapter 1: Introduction and background. This chapter introduces the study, states the research problem, the research questions and objectives, and rationale for the study. The definitions of important terms and an overview of the research methodology are also provided in the chapter.

Chapter 2: Theoretical framework and ICT education in South Africa. This chapter reviews literature on the use of ICTs in education with a special focus on South Africa. It also discusses a theoretical framework based on selected learning theories, namely constructivism, behaviourism and connectivism with reference to ICT use.

Chapter 3: The introduction of ICTs and their impact on teaching and learning. The chapter reviews literature on ICT use in schools for teaching and learning. It reviews literature on the use of ICTs in South Africa, other African countries and Europe. It focuses on the use of ICT and three different teaching modes: traditional teaching mode, blended teaching mode and the online teaching mode. It seeks to establish the differences and similarities in ICT integration and use in teaching and learning. It explores the positive aspects of ICTs in different countries and how these can be adopted in South African schools.

Chapter 4: Research methodology and design. This chapter discusses the research methodology and design that was employed to investigate how ICTs can be used effectively to enhance teachers and learners' performance in Soweto secondary schools. It gives the rationale for the choice of a mixed methods approach and outlines the population and sample of the study. The chapter also describes the data collection process and instruments used in the study, namely semi-structured interviews, questionnaires and recording instruments. It also explains the data analysis process, research validity and trustworthiness

Chapter 5: Data analysis, presentation and discussions. This chapter discusses data analysis, presentation and discussion of findings derived from the interviews and questionnaires. The analysis looked at the recurring patterns or themes and organised them thematically. The chapter also discusses, analyses, presents and interprets the data guided by the main research question, sub-questions and objectives of the study.

Chapter 6: Summary, conclusions and recommendations. The chapter gives a summary of research findings, draws conclusions of the study and proposes recommendations on how to improve practice on effective integration and use of ICTs in schools. The limitations of the study are also discussed and areas for further research are suggested.

1.11 CHAPTER SUMMARY

The chapter introduced the study, stated the research problem and gave the rationale for the study. It highlighted the introduction of ICTs in Soweto public secondary schools and the effectiveness of the programme. It probed whether the use of ICTs enhances teachers' efficiency and student learning in schools. It explored teachers' experiences in handling ICTs in the classroom and how these ICTs influence teaching and learning. The chapter also presented an overview of the theoretical framework that underpins the study and explained the importance of ICT integration in education, which is to optimise learning and improve student outcomes. This study is important for South Africa since the government has adopted e-learning as a new approach to teaching and learning. The chapter also highlighted the challenges that could impact effective implementation of e-learning in Soweto public secondary schools. The mixed methods approach selected for this study including its components of quantitative and qualitative methodologies are explained.

CHAPTER 2

THEORETICAL FRAMEWORK AND ICT EDUCATION IN SOUTH AFRICA

2.1 INTRODUCTION

The previous chapter introduced the study, and provided its background, significance and research problem. This chapter explores the theoretical framework that underpins this study in relation to ICT integration in schools. It also provides an overview of the current and anticipated future use of ICTs in teaching and learning in South African schools to shed light on how this can be optimised in the classroom. The chapter also presents the general landscape of e-education in South Africa and reviews the emergence of ICT policies in East Africa to understand how other African countries handle them.

2.2 THEORETICAL FRAMEWORK

Globally, access to education has increased through online learning which has prompted the emergency of the new learning theory called ‘connectivism learning theory’ (Jepchumba & Gaceri, 2013:615). Therefore, access to technology and the internet has also increased, and countries should ensure that schools are ready to embrace technology (Zhang, Tao, Chen, Sun, Judson & Naqvi, 2018: 390). This study is underpinned by connectivism learning theory to shed light on how ICT integration can improve the quality of education in schools. In this regard, the strengths and weaknesses of connectivism learning theory are assessed. Harasim (2012:4) postulated that the main aim of a learning theory is to assist the researcher to understand how people learn as explored in Section 2.2.1 below.

2.2.1 Connectivism Learning Theory

The connectivism learning theory was found to be the most relevant to address the research questions in this study meaningfully. The learning theory is regarded as a relevant theory for the digital age since it is presumed to accommodate knowledge construction and learning objectives (Downes, 2022:58; Siemens, 2004:4; Yu, 2021:61). However, Masethe, Masethe and Odunaike (2017:2) argue that connectivism as a learning theory was developed to eliminate the limitations associated with behaviourism, cognitivism and constructivism theories. In agreement with Siemens, Dunaway (2011:675) and Walters (2021) postulated that as a learning theory, connectivism affords learners an opportunity to form connections with the information flow that takes place among the network members. This is significant since modern-day learning can use network connections for individuals to share their knowledge, expertise and opinions using online platforms. Garcia, Brown and Elbetagi (2013:254) further maintained that connectivism as a learning theory helps learning to take place since peers can collaborate, share opinions and critique one another through dialogue.

With so much information that learners encounter daily, collaboration tools become essential in transforming them into better individuals who can successfully manage time and organise their tasks optimally (Couros, Garcia, Brown & Elbetagi, 2012:165). Therefore, connectivism builds on the principles of known learning theories which assist learners to perceive knowledge as transmitted facts and acknowledges the important role played by unique cognitive skills in processing information successfully, and how collaboration plays a vital role in distributing the information through networks to connect and access current knowledge (Bell, 2011:3). Connectivity theory gives teachers and learners the freedom to connect and form networks and community platforms since it is socio-technological in nature. It also allows them to access, share, think and distribute current knowledge; hence, it is relevant to ICT (Oddone, 2018).

Therefore, connectivism as a learning theory in this study is relevant as it allows teachers and learners to establish networks and nodes for knowledge acquisition and sharing in real time to empower themselves and their peers (Bartolome & Steffens, 2015:96). Teachers can also share and interact with their peers helping improve their knowledge scope for subjects they teach and acquire new ideas on how to improve their teaching techniques. In this respect, Downes (2022:58) and Siemens (2004:4) maintain that connectivism is aligned to, and suitable for, learning in the digital era that still permits learning knowledge construction and learning objectives. Corbett and Spinello (2020:2) argue that connectivism learning theory was introduced as a learning theory on the assumption that knowledge exists in the world and can be easily retrieved and shared. However, Siemens (2004), the founder of the theory, argues that, although connectivism is the latest learning theory, it disregards older theories such as behaviourism and constructivism. Instead, connectivisim as a theory focuses more on the explanation of new developments, which are not catered for by older theories.

Connectivism learning theory is believed to originate from other theories like behaviourism, which emphasise the importance of external factors that actuate learning. As a theory, connectivism states that learning resides in digital appliances (Boyraz & Ocak, 2021:1125). ICTs allow information flow since they can transcend geographical boundaries and simultaneously increase learners and teachers’ capacity to explore more than what is currently known. By implication, there is a need for connections to be well nurtured and maintained to facilitate ongoing learning. This is important since online learning requires stable network connections skill (Utecht & Keller, 2019:113). On the other hand, network members also require other skills like the ability to identify accurate, up-to-date knowledge in connectivist learning activities and make decisions in their learning processes. In this sense, learners are expected to choose what they need to learn and be able to understand the meaning of incoming information (Utecht & Keller, 2019:108).

2.2.1.1 Learning and connectivism

The successful use of ICTs in the teaching and learning process in the classroom mainly depends on the attitudes and competencies of the teachers (Ferrari, Cachia & Punie, 2009:363; Isling, 2013:656; Maisela, 2021:19; Starkey, 2011:24; Tedla, 2012:200). This means that teachers should guide learners on the type of content they need in a connectivist environment since they are key figures in ensuring that ICTs are integrated into teaching and learning. Studies have shown that learning information that is developed in foreign cultures may clash with local material and beliefs (Isling, 2013:656). However, connectivism focuses on the use of cognitive domains such as cognition and emotions, which contribute to the learning act in significant ways and disregard cultural differences in learning. This is indicated by the execution, volitional control and self-reflection, which address motivational and behavioural characteristics to achieve set educational goals (Bortolome & Steffens, 2015:96). Cognitive learning theorists like Piaget concur that individuals learn best from internal processes, which include, among other things, insights, information processing, perceptions and memory (Cleary, 2021:13). As Nussbaum-Beach and Hall (2012:11) observe, today's learners must learn to do things by themselves. As such, learners should be at the centre of the learning experience and not the teacher or institutions. They should also be instrumental in determining the content of learning (Dziubaniuk, Ivanova-Gongne & Nyholm: 2023:14). Utecht and Keller (2019: 113) argued that the learning process in connectivism is characterised by connecting information sets and helping learners see the connection between events and ideas. In this regard, Dziubaniuk et al. (2023:23) aptly averred that learning is a process of connecting specialised nodes or information sources. These two important skills stressed in connectivism contribute significantly to learning and teaching in the classroom.

2.2.1.2 Teaching and connectivism

Though e-learning affords teachers opportunities to be connected in a community of learning (CoL) and share knowledge with people who have the same interests anytime and anywhere, they are constantly faced with a challenge of having to decide what should be taught because of the massive amount of information on the web applications. Therefore, teachers should be vigilant about the credibility of information posted and shared on network platforms. This could ensure that they are not overwhelmed with information streaming from these networks (Downes, 2022:74). It is critical that teachers should be well versed with connectivism and its principles to give learners better guidance on where they can acquire information. Connectivism principles suggest that individuals should use modern-day reservoirs of information to acquire new information (Tigere, 2020:108). However, Nyathi (2022:25) noted that in a connectivist environment, teachers may become irrelevant as they may be replaced by computers. This means that e-learning could give learners an opportunity to choose what they want to learn (Alpizar & Hernandez, 2017). Learners can easily create new knowledge when they engage with other learners on networks away from formal education settings. However, the presence of teachers is necessary to guide learners to choose what they want to learn and help them construct their own knowledge.

There are three major reservoirs from which individuals can acquire knowledge, namely, online classrooms that include a huge amount of open online courses; social networks that include video clips and podcasts; and virtual learning platforms (Lin et al., 2007:100). Figure 2.1 depicts these three major reservoirs of information.

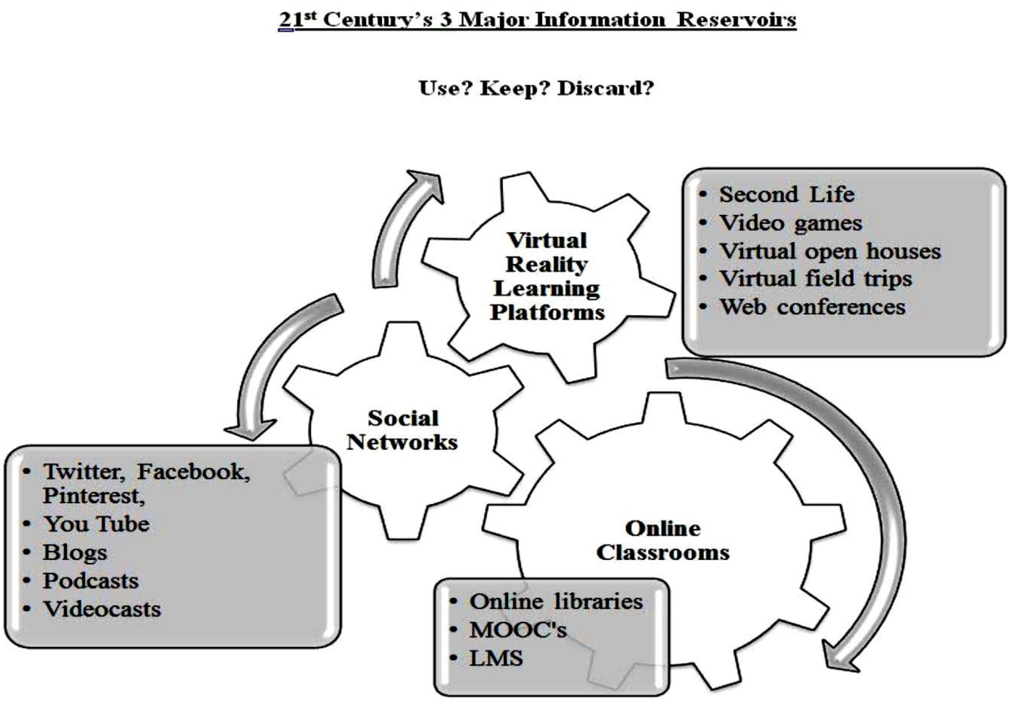

Figure 2.1: The information reservoirs

Source: (Adapted from Kropf, 2013)

2.2.1.2.1 Online courses and classrooms

In the digital age, learning consists of online courses that are delivered synchronously and asynchronously (Martin, Sun, Carl & Westine, 2020:159). The offer of these open online courses is increasing massively, and many learners take advantage of the low costs and convenience that these open online courses have to offer. Many colleges and universities offer these courses to attract more students.

2.2.1.2.2 Social networks

Social networks are the apex of generating ideas since they are premised on the notion that knowledge can be built on each other's knowledge base (Azizi, Soroush & Khatony, 2019:2). In this respect, business and educational institutions use social networks in meetings, for branding purposes and in their marketing endeavours. Organisations' marketing strategies are, therefore, centred on both social networks and in traditional advertising campaigns. Therefore, with a presence on the internet, companies can have better chances of getting prospective customers and increase their clientele base (Kijkuit & Van Den Ende, 2007:863).

2.2.1.2.3 Virtual learning platforms

Network learning in the virtual world is transformed into a 3-D learning space where learners are substituted by avatars (Lin et al., 2007:101). Virtual learning platforms are good because they encourage both teachers and learners to be creative. Simultaneously, they encourage virtual collaboration (Ghorbani, Jafari & Sharifian, 2018:20). Virtual platforms afford both teachers and learners access to activities that enable avatars to talk, walk and move and point out objects. These create social and intellectual interactions (Azizi et al. 2019:2).

2.2.1.3 Criticism of connectivism as a learning theory

In addition to the supply of ICTs in schools and the strategies developed by the government and other stakeholders in South Africa, there is a large volume of information available on the internet. Therefore, there is a need for teachers to guide learners on what information to search for and filter out. One of the criticisms directed at the connectivist approach to teaching is online teaching and learning without a teacher because researchers feel that teachers should be present to guide and monitor learners' progress (Hendricks, 2019:4). Another fundamental criticism raised by researchers is that although connectivism is regarded as a tool used in the teaching process, it is difficult to consider it as a learning theory. Instead, they view it just as a phenomenon that serves to inspire teachers and learners and help them make changes to their activities (Utecht & Keller, 2019:107). According to Dacholfany, Saifi and Sulaiman (2022:3), three main facets characterise a good theory. Firstly, a good learning theory is one that contributes theoretical knowledge. Secondly, it directs how learning should take place by providing significant new perspective on how learning occurs, and thirdly, it must be accurate in its representation of historical alternatives. However, it is not so with connectivism since it does not explain how learning occurs as in other learning theories like behaviourism and constructivism. The only good thing is that, although connectivism disregards theories like behaviourism and constructivism, it has some elements of informal learning in it that are found in digital mediated settings (Dacholfany et al. 2022:2).

Although connectivism has been used as a replacement for behaviourism and constructivism theories, nothing much is added to the principles of existing theories. Verhagen (2006:1) asserted that connectivism is rather a level of curriculum as opposed to theory since it mainly concerned with what people should learn and the skills they should develop. By implication, at a curriculum level, connectivism plays an important role of developing new pedagogies thereby shifting from the teacher to more autonomous learners. On the contrary, when it is a theory, people will still learn the same way but adapt to the changing technological landscape (Ahmed & Hasegawa, 2019:364). Interestingly, connectivism uses knowledge stored electronically in non-human appliances like E-books, journals and libraries. However, challenges like memory limitations have been counterbalanced by writing notes or things down, using modern cognitive tools to create databases and printing books (Camargo, 2022:8). In this regard, Kop and Hill (2008:4) emphasise the importance of observing a phenomenon over time, and eventually developing a theory that explains it.

Connectivism can still be regarded as a learning theory despite a lack of vigorous research and observations. This is because one of the key facets of connectivism is knowledge that is stored in non-human appliances as mentioned earlier. When connectivism is used, the assumption is that in all institutions, the learning environments are furnished with the kind of technology needed to carry learning activities aligned to connectivism. Institutions need to form diverse networks on connections, communications and -sharing and collaboration with one another. However, in schools in poor and underdeveloped countries, this assumption is not true as schools lack internet access and have poor ICT competencies (Dzansi & Amedzo, 2014:345; Moll & Ndlovu, 2010:142; Tella, Tella, Toyobo, Adika & Adeyinka, 2007:10; Tigere, 2020:116). Researchers such as Arends (2021:140) and Chisango (2019:302) concur that in South Africa, ICT research in schools has highlighted insufficient support, a lack of communication, a lack of training, low levels of confidence and proficiency, and a lack of network literacy as some of the barriers that inhibit ICT integration in education.

As a learning theory, connectivism proposes that learners should use the network to acquire information and have discretion to select their own knowledge. Therefore, learners can decide on how the acquired knowledge can be used to empower themselves. This adheres to the constructivist principles of active collaboration, participation, meaningful attribution, decision-making, and knowledge creation embedded in learners’ rights (Camargo, 2022:10). Despite the criticisms levelled against connectivism, it is currently the most appropriate learning theory to explain the digital age and technology integration in education.

Adarkwah (2021:1665) defines ICTs as “technologies used to convey, manipulate and store data by electronic means.” Coman, Tiru, Meseșan-Schmitz, Stanciu and Bularca (2020:6) further postulate that emails, SMS text messaging, video chat (e.g., Zoom, Microsoft Teams and WhatsApp), and online social media like Facebook and Mixit and other devices such as smart phones and laptops form part of these technologies that are used to manipulate, convey and store information. The availability of a wide variety of ICTs suggests that learners and teachers in the classroom should go beyond computers and the internet. ICTs are a major foundation of any economy, be it poor or wealthy (Chisango, 2019:3). Moreover, ICTs play a vital role in education and development as they are the main facilitator of the knowledge society (Varghese, 2020:66). However, local circumstances, political ramifications and social processes highly influence ICT implementation and determine the outcome (Varghese, 2020:10). In the context of Ghana, Adarkwah (2021:1665) echoes similar sentiments that technology is a cultural product shaped by the culture of people. Furthermore, it should be directly accessible and appreciated by a large section of the population. Therefore, it is important that the use of ICT in South African classrooms should be explored focusing on teachers' capabilities on the use of ICTs and relevant language.

A closer look at the global context reveals that ICT is strongly grounded on the Western cultural hegemony, knowledge and ideas (van Grasdorff, 2004:17). For this reason, some people view technology as an alien transplant, and maintain that ICT can ingrain inequalities leading to continued oppression. Some people argue that having universal access to ICTs does not necessarily guarantee equal opportunities and freedom to use and shape technology (Juggernath & Govender, 2020:367). Therefore, it is essential to recognise the dynamic relationship between the local culture and ICT integration. The use of ICTs in South Africa needs further attention because of the country's cultural complexity, particularly the fact that it has been a segregated nation for too long (Munje & Jita, 2020:263).

This study was conducted in Soweto township schools, which still struggle to get the basic infrastructure, and the appropriate types of equipment, namely computers (desktops and laptops), data projectors, photocopy machines, interactive whiteboards, digital cameras, television sets (TVs), internet, CD/DVD players, radios and tape recorders. However, literature suggests that there has been a significant growth in the use of ICTs in education in developed countries (Maisela, 2020:31). Although there has been a tremendous increase in the use of ICTs in education in developed countries, Mkhize (2019:13) observes that their use and integration into the school curriculum in developing countries is still lacking or insignificant.

This study highlights some of the challenges confronting ICT integration in South African schools and classrooms. This is done by focusing on the concept of a digital divide, and how cultural complexity, which focuses on language, can affect the divide in schools that already have material access to ICT. It is argued that the challenges of language in South African schools can exacerbate the digital divide among learners who are already disadvantaged due to a range of social inequalities. Therefore, for learners to fully master the use of ICT in today's global knowledge society, it is important to make sure that the local context which includes the use of a familiar language is put in place.

Although connectivism is the theory that underpins this study, there are other theories that exist that gave birth to connectivism as a theory. Two other major theories which influenced the birth of the connectivist theory, namely behaviourism and constructivisim are discussed as they form the building blocks for connectivism as a theory (van den Berg, 2017:75). Although these theories were developed in the digital age when ICTs were not highly influential in the education system, one cannot mention connectivisim as a theory without these two theories.

In summary, connectivism as a theory incorporates aspects of both behaviourism and constructivism, but it expands upon them by highlighting the role played by networks, technology and distributed knowledge. It acknowledges the importance of individual learning process while emphasising the need for learners to be proficient in navigating and leveraging digital networks to access and integrate information effectively. To understand more about this connection among these learning theories, an overview of the behaviourist learning theory and the constructivist learning theory, which were precursors to connectivisim learning theory is provided in the following sections. The intention of the theoretical review is to establish how the other two learning theories are interconnected to connectivist theory in advancing knowledge and how each learning theory fares when it comes to teaching and learning of ICTs in the classroom (Tigere, 2020: 21).

2.2.2 Behaviourism as a Learning Theory Prior to Connectivism

The most prominent proponents of behaviourism learning theory were Ivan Pavlov, John Watson and Burrhus Skinner (Schunk, 2008:27). Ivan Pavlov's first publication was his 1887 text (The digestive glands) which centred on his psychology research, while John Watson's first major work, "*Behaviour: An introduction to comparative psychology"* was published in 1914 and Burrhus Frederic Skinner's first work, "*The behaviour of organisms"* was published in 1938. Their contributions to behaviourism theory played a pivotal role in shaping education worldwide and many educational institutions in the world incorporated the theory in their education systems (Ng'andu, Hambulo, Haambokoma & Tamaida, 2013:58). In education, behavourism is mostly associated with Skinner's operand theory, which asserts that learning is largely determined by the external environment (Campbell, Craig & Collier-Reed, 2020:30).

Behaviourism assumes that for a learner to respond according to what the teacher anticipates, they should be conditioned by a stimulus. Al Dahdouh, Osorio and Cares (2015:14) concurred that behaviourism as a learning theory conceives knowledge as physical objects that learners should possess, and that learning is a process, which transfers facts to learners using a mechanism of rewards and punishment. Therefore, the learner is not responsible for their learning, but there is an attempt by the teacher to engineer how certain content can be delivered and assessed, and how the learner's response can be reinforced (Ertmer & Newby, 2013:50).

2.2.2.1 Behaviourism and learning

Skinner's perspective shows that human learning can only be explained in terms of behaviours that are observable and that environmental conditions always influence the change in behaviour. Feldman and McPhee (2008:41) affirmed that all human behaviours can be described and predicted based on their association with the external stimuli and how they respond to these stimuli. The behaviourists believe that there are external (or hidden) mental operations and events, but do not necessarily consider them when it comes to describing learning. They believe that learning is caused by external, observable environmental events (Feldman & McPhee, 2008:41). In agreement, Schunk (2008:16) described behaviourist learning as a change in rate, frequency or occurrence, behaviour or response, which occurs primarily due to the influence of environmental factors. Therefore, in behaviourism, learning takes place when a learner responds to a stimulus. Altuna and Lareki (2015:3) concur that in terms of behaviourism, a change in behaviour of a learner can take place only by using a system with both positive and negative rewards. This means that in behaviourism, the desired response is necessitated by using reinforcements to ensure that the same behaviour will recur (Dede, 2008:46; Ertmer & Newby 2013:51).

2.2.2.2 Basic assumptions of behaviourism

Feldman and McPhee (2008:29) asserted that all the dominant forms of behaviourism have the following principles:

(i) The link between a stimulus and the response produced is predictable and reliable.

(ii) If you study and manipulate the environmental conditions that influence behaviour, it is highly possible to predict and shape to a high degree of certainty, the behaviour of someone in a specific situation and time.

(iii) All behaviour is learned habits and accounts for how these habits are formed.

(iv) You can strengthen or weaken a learner's behaviour by introducing different reinforcements.

The learning process in the behaviourist theory can be described as the following A-B-C model below:

A (Antecedent) → B (Behaviour) → C (Consequence)

According to the model above, the environment (teacher, parent or instructional system) is the first to present the antecedent (stimulus) that can in turn trigger a certain behaviour (response) followed by some consequence (reinforcement). Adding a reinforcement to stimulate a response is likely to encourage a certain behaviour to be repeated in future. When the behaviour is seen to be repeating itself, then learning is said to have taken place (Schunk, 2008:47-48).

2.2.2.3 Behaviourism and teaching

According to behaviourism theory, the teacher oversees the subject matter and has total control over the amount, manner and sequence when it comes to the delivery of information. Teaching is, therefore, perceived as a process where information is transferred, conveyed, dispensed and mapped by the teacher to the learner (Feldman & McPhee, 2008:42). In the same vein, the teacher assumes another responsibility of arranging the environment conditions so that learners can be aided in their learning (Newby, 2006:28). However, for learners to learn optimally from the environment, the teacher should consider the following:

a) Instructional objectives should be specific, and at the end of the lesson, one should be able to tell if learning was successful and has occurred. The teacher should identify the goal and further break it down into a set of simpler behaviours, which when combined, can bring out the desired outcome.

b) The teacher must use cues to guide learners so that they can achieve the intended goal. The cues can be gradually drawn so that the desired behaviour can be linked to the desired antecedent.

c) The teacher should use consequences either to reinforce or discourage a certain behaviour (Newby, 2006:28).

2.2.2.4 Behaviourism and learning content

Learning knowledge, according to behaviourists, is not something that always stays in our minds, but rather, it guides our actions and makes us capable to do certain things. This view sees knowledge as repeated actions that can be performed or demonstrated (Feldman & McPhee, 2008:42). Behaviourists further believe that there is a real world external to humans, which is structured and independent from human experience. For this reason, behaviourists structure and compartmentalise this real world into a curriculum with discrete, separate subjects that do not accommodate cross-curricula integration. For behaviourists, it is possible to model, map and structure this reality so that it can be transmitted to the learner. Therefore, behaviourists believe that learning content can be simplified and broken down into smaller manageable units and presented to the learner piece by piece (Pritchard, 2009:12).

2.2.2.5 Behaviourism and the use of ICTs in teaching and learning

The behaviourist theory postulates that the transmission and communication of knowledge is done through teaching (Campbell et al., 2020:30). In this theory, the learner is assumed to be passive and only responds to an incentive-oriented environment (Masethe et al., 2017:2). The role of transmitting and communicating knowledge is done by using ICT tools in behaviourism. Computers can be used to transmit and communicate information, which is called computer-assisted instruction also known as computer-based instruction (Chisango, 2017:94).

Computer-based instruction includes, among other things, discussions, quizzes, blogs, games, wikis, assessments, problem-solving programmes, simulation programmes and tutorials. This was commonly used in learning since the 1970s until recently and are based on the approaches of behaviourism (McPhee, 2008:45). When these technology applications are used in the learning process, learners become fully engaged in the learning process (Arghode & Wang 2016:111). In terms of the behaviourist theory, technologies can be used to transmit knowledge and information that will help learners realise their objectives. In an ICT-resourced environment, the learner can benefit from different technological tools which can serve as stimuli to the learner’s quest to acquire knowledge (Dede, 2008:46). Drill and practice programmes used in numeracy through the game technology, especially in elementary mathematics and languages, cultivate the basic skills needed by learners to handle abstract learning and the development of higher-order thinking skills (Shin, Sutherland, Norris & Soloway, 2012:549).

When it comes to enhancing learners' cognitive development, the game rules are also regarded as vital. Through games, learners can improve their cognitive development and abstract thinking skills, which include organising ideas with certain properties into groups or by using patterns. In this regard, Cox, Webb, Abbott, Blakeley, Beauchamp and Rhodes (2003:19) concluded that simulations help learners in the acquisition of knowledge and retention of facts. However, Duffy and Cunningham (2008:19) criticised the use of ICTs in teaching and learning in the sense that, in terms of behaviourism, learners are expected to react to ICT tools instead of using them to simplify the teaching and learning process. For this reason, the theory is criticised because it applies in a lower-level skills-learning environment, which led to the behaviourist learning theory being replaced by the cognitivist learning theory (Masethe et al., 2017:2).

2.2.3 Constructivism as a Learning Theory Prior to Connectivism

Constructivism is viewed as a learning theory developed to counter reactions to behaviourism. According to Ertmer and Newby (2013:55), behaviourism disregarded mental activities. They maintain that there was a need to adopt a theory that accounted for how learning occurs within the learner; hence, the introduction of the constructivist theory of learning. The main emphasis of constructivism is on the way individual learners, through their cultures, backgrounds and environments acquire and develop their understanding and knowledge. Campbell et al. (2020:31) concur that the central claim of constructivism is that learners should construct new knowledge based on prior learning. Unlike behaviourism, some of the merits of constructivism include interaction, meaningful attribution and the construction of knowledge by individual learners or a group of learners (Roberts & Potrac, 2014:181). Many countries have adopted this theory mainly because it emphasises that learners are responsible for constructing their own knowledge instead of having it imposed onto them. It discourages the idea of teachers filling up learners with information and regarding them as experts (Campbell, 2020:31). In constructivism, learners are afforded an opportunity to generate solutions to problems that they encounter with less help from the teacher (Duffy & Cunningham, 2008:11; Ertmer & Newby, 2013:55; Roberts & Potrac, 2014:182).

2.2.3.1 The nature and principles of constructivism

There is a distinction between cognitive and social constructivism that is made by constructivist. Wang (2008:413), Brown (2006:116) and Felix (2005:92) described cognitive and social constructivism as an individual's construction of an activity in their endeavour to make sense of the world. On the other hand, social constructivists maintain that knowledge is also a result of cultural and social processes that play a major actuating role that influencing learning rather than being perceived as only mental (Wang, 2008:413). However, constructivists such as Roberts and Potrac (2014:181), Brown (2006:115), Vygotsky (1978:84) and Cunningham (2008:2) are of the collective view that constructivism is a learning process where learning is regarded as an active process of construction and not only the acquisition of knowledge. Therefore, in the cognitive constructivist's approach, focus must be on the individual and not the group. The assumption is that cognition occurs in the head of the individual, and learners make intellectual sense of the material on their own using cognitive tools. The cognitive tools are also referred to as mind tools that engage and facilitate the cognitive process (Felix, 2005:86; Wang, 2008:413). The belief is that when people interact with their environment, they can develop a framework to explain their current and future actions. According to Duffy and Cunningham (2008:14), this can only happen in situations where teachers and those who are deemed more knowledgeable are tasked to mentor others in problem-solving situations. This is done until the skill or knowledge is appropriated and mastered so that self-regulation and independence are achieved or ensured.

Vygotsky (1978:84), who is the founder of socio-constructivism, emphasises the need to include cultural and social content in learning. It is suggested that higher cognitive functions in learners like thinking and learning are embedded in a social, interactional, cultural, institutional and historical content. Vygotsky (1978:84) further asserts that external and environmental factors and other related activities are important in igniting internal construction and for the development of human cognition. However, the issues discussed above on cognitive constructivism and socio-constructivism indicates how learning can be enhanced when both socio-constructivism and cognitive constructivism are used especially when dealing with learners who have different learning potentials. Furthermore, interactional functions brought about by cognitive constructivism and socio-constructivism assist learners to achieve beyond the Zone of Proximal Development (ZPD). Roustaee, Kadir and Asimiran (2014:25) defined ZPD as the difference between what learners can do and cannot without help. On the contrary, Livingstone (2015:25) is of the view that ZPD is less advanced, and learners must get help from adults or more experienced learners if they are to master concepts and ideas that could prove challenging. The relevance of social constructivism in this study is that it affords teachers access to teach learners at their ZPD stage using the learners' preferred learning styles (Shin et al., 2012:452). This approach allows the teacher to take up the facilitator's role or coach who can use teaching strategies with ICTs. This is vital because by interacting, knowledge sharing and hands-on experience knowledge construction, development and collaboration are encouraged among learners.

Therefore, to ensure that teachers and learners are involved in meaningful activities by using mental processes and collaboration constructivist principles are vital in the teaching and learning process. Most importantly, the constructivists agree that learners learn through active participation (Chan 2006:4; Dede, 2012:53-55; Felix, 2005:92; Shelly, Gunter & Gunter 2010:376). Through participation and interacting with their surrounding environment, learners become creative and skilled thinkers who can create personal views of the world around them. For this reason, learners become hands-on and are engaged in authentic, meaningful learning. Akpan and Beard (2016:393) agreed that constructivism implies that knowledge is constructed and not transmitted. By using constructivist tools, learners can meaningfully derive the meaning of knowledge collectively constructed with fellow learners and not view teachers as the only source of information. This could amplify the teacher's role as a facilitator, coach and motivator and make teachers cease to be information transmitters (Kler, 2014:26). When using the constructivist's approach, the teacher takes the role of the facilitator, where they guide the learner with the objective of making the learner become actively involved in creating their reality by understanding and attaching meaning to the learning context.

Another important principle of constructivism is that learners should continue to actively construct knowledge and anchor new information to the pre-existing knowledge. This is an important principle because learners can make interpretations of knowledge in terms of their own experiences. Social constructivism posits that prior knowledge, culture and social relations also serve as a source of knowledge and scaffolding for the construction of new knowledge (Hung, 2001:283). When using the constructivist approach in learning, learners are afforded the opportunity to take control over the sequence and selection of content, to actively construct their own knowledge and apply it realistically to given tasks. They also have the liberty to learn at their own pace, and simultaneously, take control of their learning since this approach takes into consideration different learning styles and individual differences. When learners use the internet, it exposes them to numerous avenues of information, and they can select what they want to learn. This supports lifelong learning that is recommended in the twenty-first century (Chan, 2006:6; Vygotsky, 1978:90).

2.2.3.2 Teaching and Constructivism

Teaching in constructivism focuses on the individual in an effort to help the individual become a knowledge constructor who can identify, analyse, think critically about their own views and those of other learners, and solve problems (Shelly et al., 2010:379). In constructivism, it is the responsibility of the teacher to understand the cultural content and learning styles that learners prefer so that they can create environments that motivate them to seek knowledge constantly. In constructivism, the teacher's responsibility becomes that of a facilitator. (Brown, 2006:115; Dede, 2012:52). The teacher takes up the role of guiding and coaching learners to acquire, explore, discover and generate new learning ideas and creates opportunities for collaboration. Learners are expected to think critically and embrace learning that invokes problem-solving (Akpan & Beard, 2016:394). In addition, the teacher should provide an environment that stimulates the learners' intellect and ask interesting and exciting questions (Altuna & Lareki, 2015:5). When using a constructivist approach, the teacher should give clear instructions since a lack of clear guidelines for learners on how to approach certain learning activities can be problematic. In a constructivist setting, too much information on the internet can confuse learners in making the right choices about the information that is relevant to their learning situation.

2.2.3.3 Learning and the use of ICTs in constructivism

When constructivist principles are used in the teaching and learning process, learners cease to be only recipients of instruction, but they can construct their own knowledge using available resources (Felix, 2005:88; Wang, 2008:413). This is because teaching in constructivism focuses on guiding learners to build on and modify their existing mental models so that they can construct knowledge rather than simply transmit it. This approach promotes active learning and participation when learners interact with the surrounding environment, simultaneously giving them an opportunity to function as part of a community to help solve real-world problems. Constructivism is regarded by many educational thinkers as a suitable framework to use for learning environment in the future because of its practical nature (Wang, 2008:413).

In constructivist learning, it is the teacher's role to create a model of knowledge production, inspiring learners to initiate the construction of their own understanding and knowledge. Vygotsky (1978:90) concurred that learners need adult guidance or collaboration with more peers for learning to take place in the learners' ZPD. For this reason, learning in constructivism involves participating in and interacting with the surrounding environment to create a personal view of the world rather than mirroring a common view of the world (Allahyar & Nazari, 2012:82; Roustee et al., 2014:147). This makes the learner an active thinker who can construct their own knowledge through interacting with objects and ideas.

Constructivism describes learning with technology using resources such as computers, the internet, smart phones and other interactive technological resources. Constructivism and ICTs are well aligned, and for that reason, learners can construct their own truths using new learning models that teachers use in their ICT-based interactive lessons (Sekgwelea, 2007:18). In support, Mcloughlin and Lee (2008:643) argue that when ICTs such as web surfing, e-mail and the internet are made available to learners, a terrain for networked, collaborative social learning is created which brings about collective intelligence that can be used to generate richer and sophisticated ideas.

Anchored on the social constructivist theory, online learning environments can provide learners with a safe and comfortable space to share information by using blogs and emails. These tools afford learners the chance to work and collaborate with other learners in tackling common goals, exchanging opinions, clarifying meanings or jointly addressing common problems (Rae, Roberts & Taylor, 2006:521). Therefore, ICTs play an integral part in affording learners an opportunity to communicate and collaborate among themselves. Wang (2008:413) also affirms that the internet is an ICT tool used by learners for scholastic and social purposes. The same internet is also used by learners to search for and access information, send emails and contact other people such as experts other than teachers and parents. When learners have smartphones, they can access the internet which will allow them to send messages, chat with friends and help one another on education-related issues (Osman et al., 2010:12).

Cavas et al. (2009:21) argue that learners' confidence and motivation is increased through the use of ICTs in constructive teaching and learning, thereby making it easy to capture the learners' attention and interest. It is further asserted that by using digital media, learners are afforded the opportunity to use newly acquired knowledge successfully in simulated situations. By using computer networks or computer mediated communication (CMC), learners can argue, solve problems, negotiate meaning or engage in other pedagogical activities which include among other things modelling, coaching and scaffolding of performance (Dema & Moeller, 2012:76). This helps to build learners into knowledge producers, particularly because today's learners do not value absorption or rote learning of factual information when it is easy for them to access and use the internet to search for whatever information they need. However, the new trends in the field of ICT, its development, the knowledge available, accessibility by anyone anywhere and anytime defeat the fundamental purpose of the constructivist approach. Thus, some people criticise this approach as discussed in the next section.

2.2.3.4 Criticism levelled against constructivism in teaching and learning

Although in constructivism, the main emphasis is on the value of ICTs in knowledge construction and information discovery both inside and outside the classroom using the internet, the theory does not provide theoretical foundations for learning (Brown, 2006:111). It is believed that an increase in technological inventions and the vast body of information are the antithesis of constructivism and there is a call for a paradigm shift to adopting theories that are relevant to the new knowledge era. Brown (2006:115) and Osborne (1993:3) collectively viewed constructivism as a learning theory that has its emphasis on knowledge rather than a learning theory which explains how the learning process occurs. However, critics like Felix (2005:88) argued that in cooperative learning and collaboration, the challenge is that there is often a tension between the individual and the collective rationality. Therefore, working in groups may not be acceptable to certain individuals. According to Mapuya (2021:3), constructivism focuses on knowledge construction that involves internal and social negotiations without the provision of a mechanism for learners to use to create new knowledge. This makes it difficult to predetermine a prescribed sequence of activities in the teaching and learning process.

Learners have different potentials and learning styles, and as such, the constructivist model and principles accommodate these differences and foster learning. Some learners may still need guidance and frequent reinforcement from the teacher (Felix, 2005:90). The development of new trends, the inventions and the increase in ICTs to acquire information in the world and how knowledge is distributed, led to a paradigm shift away from constructivism to other learning ideologies in education. This helped provide theoretical foundations for learning.

Table 2.1: Summary of the three theories

Behaviourism	**Constructivism**	**Connectivism**
- Teacher occupies central space - Laws for the manipulation of the learning environment. - (Computer-assisted instruction?) Application includes drill and practice, games, tutorial and simulations that stimulate learning. - Passive learners only learn what is contained in the technology.	- Learner-centred approach - Support learners to construct their own meaning. - Learning is a process of construction. - Learners learn with technology and share information via internet and the social media. - Interactivity with various ICT tools in the learning situation. - Cooperative learning - Opportunities to discover knowledge through active exploration.	- Digital learning theory - Knowledge can be accessed by anyone at any time. - Navigating skills are of great importance. - Teachers and learners connect to form a network of a learning community. - Platform for interaction, sharing and thinking together. - Distribution of current knowledge. - Knowledge is stored in a variety of digital formats.

Source: (adapted from Cross, 2006)

2.3 TEACHING AND LEARNING IN THE INFORMATION AGE

The introduction of ICTs in teaching and learning has contributed to significant changes throughout the entire education system. These changes have impacted on how teaching and learning takes place in schools and show that ICTs have transformed the whole education system (Dave, 2019:56). These transformations were significant and enabled the acquisition of new skills and knowledge that are critical for teachers and learners in the information age (Ngeze, 2017:424). The introduction of ICTs has also helped learners and teachers to acquire and share information easily from anywhere in the world (Matos, Simoes & Esposito, 2014). Hallissy, Butler, Hurley and Marshal (2012:9) and (Zungu, 2022:11) concur that the information age has influenced how the education curriculum is structured, moving away from the old tradition where most of the work was done by humans. By implication, the education curriculum in the information age should adapt to these changes. Furthermore, knowledge skills required in the information age is dependent on ongoing training and up-skilling by the teachers (TechUk, 2018:23). Saavendra and Opfer (2012:8) advocate a curriculum that is relevant, addresses learners' needs and offers them skills and knowledge they require. With the emergence of the information age in the twenty-first century, it is necessary for schools to use constructivist approaches mediated by ICTs. Simultaneously, planning and monitoring activities should be in line with the learners' level of understanding and mastery of what they are learning. In the modern age, learners are expected to be active participants rather than passive recipients of information from authoritative teachers (Kuboja, 2019:46). The information age has also given rise to active and authentic learning in creating an opportunity for learners to engage in cooperative learning while using higher-order thinking skills throughout their educational experience. For Aktaruzzan, Shamim and Clement (2011:117), these qualities are paramount in preparing learners for future workplaces where ICT is prevalent, especially in the twenty-first century. However, McNully (2018) argued that South Africa is at risk of not properly providing teacher professional development that is in line with effective digital learning because it is a developing country that is still heavily dependent on labour-intensive extractive industries.

Marwala (2007:8) referred to the information age as the 4IR which is driven by artificial intelligence (AI) and cyber-physical systems (CPS). Artificial intelligence (AI) is a wide-ranging branch of computer science concerned with building smart machines capable of performing tasks that typically require human intelligence (Muller & Bostrom, 2016:1). On the other hand, CPS refers to a new generation of systems with integrated computational and physical capabilities that can interact with humans through new modalities (Samad & Annaswamy, 2011:1) Presently, learners and teachers are faced with a world transformed by technology, where the internet, cloud computing and social media create different opportunities and challenges for the formal education system. Retief (2019:1) concurs that not much is being done by the education department to prepare South African learners to face the challenges brought by the 4IR. Furthermore, Mihaescu and Andron (2019 in Sikhakhane et al., 2021:2) assert that there is a need for the adoption of a pedagogical curriculum that will give new and responsive skills aligned with the digital world.

Marwala (2007:8) further provides a narration of other key revolutions that took place before arriving at the 4IR which sheds light on how we arrived at the 4IR. Poór, Ženíšek and Basi (2019:496) postulate that the first industrial revolution caused the society to shift from being hunters and gatherers to becoming farmers. This started at the end of the 18th century to the beginning of the 19th century (Pouspourika, 2019, in Mhlanga, 2020:14). The revolution brought a change in the use of energy sources, forms of transport, information transfer and industrialisation of production (Poór et al., 2019:496). The introduction of new methods in agriculture and machinery as an alternative for field cultivation, led to the industrialisation of countries (Volek & Novotna, 2017:1790). From there onwards, motion was better understood and quantified, and it was possible to design steam engines that mechanised much of the work that was traditionally done by humans (Dunga, 2019:3). Mechanisation therefore led to agriculture being replaced by industry as the backbone of the economy (Gleason, 2018:978). The main activities of this industrial revolution were the extraction of coal and the invention of the steam engine. The invention of the steam engine later helped to shape the manufacturing industry and led to the establishment of railroads which played a pivotal role in accelerating the economy (Mhlanga, 2020:15).

The second industrial revolution was catalysed by Faraday and Maxwell who identified magnetic and electric forces that led to electricity generation and the electric motor which were instrumental in the assembly lines that have come to dominate many industries (Marwala, 2007:8). The discovery of electricity changed the lives of people for the better. Poór et al. (2019:496) concur that the second industrial revolution resulted in mass production based on division work and electricity powered lines. It started at the end of the nineteenth century. It brought about massive advancements in the industries (Deloitte, 2018:1). The advancements in industry helped with the discovery of a transistor which ushered the electronic age that gave us computers and the internet. Other notable achievements that were witnessed in the second industrial revolution include among other things, steel manufacturing, chemical synthesis and methods of communication such as telegraph and the telephone. The final invention in the second industrial revolution was that of the automobile and the aeroplane at the beginning of the twentieth century. This made the second industrial revolution very important (Pouspourika, 2019, in Mhlanga 2020:15).

The third industrial revolution was catalysed by the discovery of a transistor, which ushered in the electronic age that gave us computers and the internet. The third industrial revolution was in the second half of the twentieth century (World Economic Forum, 2017:6). This revolution brought to light many untapped energy sources. One notable energy resource that was discovered was nuclear energy (World Economic Forum, 2017:6). It also accelerated the rise of electronics, telecommunications and computers. This later opened doors for space expeditions, research, biotechnology and the rise of Programmable Logic Controllers (PLCs) and robots which assisted in high-level automation (Davis, 2016). Poór, Ženíšek and Basl (2019:498) concurred that the third industrial revolution was fundamental because it brought about changes in technology, brought new discoveries in automation and cybernetics, energy, research into the atomic molecular structure of matter, genetics and cosmology.

4IR epitomises a shift in paradigm from centralised to decentralised production, whereby machines no longer simply ‘process’ the product, but they are seamlessly integrated into the information network between business partners and customers (Hořánek & Basl, 2018:1797). This revolution is still happening, and the changes are happening faster due to the interconnection of the world. In this study, the business partners and customers are schools, teachers and learners (Radziwill, 2018:184). This revolution is a fusion of technologies that overlap between the physical, digital and biological spheres (Mhlanga & Moloi, 2020:15). However, Schwab (2015:91) argues the 4IR is not a prolongation of the third industrial revolution but a different revolution all together.

2.4 ICT AND ITS IMPACT ON TEACHING IN THE TWENTY-FIRST CENTURY

As discussed earlier, it is not only the lack of infrastructure that affects South African schools, but also current teaching practices needed to integrate ICTs into learning and teaching. This awareness has precipitated the DBE and GDE to encourage teachers to rethink and reshape their engagement with the curriculum that has to do with ICT integration (Padayachee, 2017:37). Teachers should understand that they should align their mind-sets with teaching in the twenty-first century. This is possible when teachers can adopt and use ICTs in their teaching and learning activities. Eventually, this could assist learners develop their potential and acquire skills needed to function effectively in the ICT age. Aguti (2016:2), Hunde and Tacconi (2013:707), Tedla (2012:199), and Mwalongo (2011:38) collectively affirm that the onus is on teachers to encourage learners to exchange information among themselves in an effort to prepare them become active participants in their communities and become lifelong learners. Tigere (2020: 38) concurs that ICTs help to consolidate collaboration skills of learners. This is something held in high esteem in global competitiveness.

Research has pointed out that teaching in the twenty-first century demands active involvement by learners in constructing their own knowledge using all available educational facilities. The researchers believe this will help learners develop higher-order thinking skills and problem-solving techniques. This is contrary to the use of traditional teaching method of transmitting knowledge to learners who in turn are expected to reproduce content. Therefore, teachers’ practices in the twenty-first century should be aligned with the expectations of the networked society, which requires teachers to modify their traditional teaching methods. The aim is for

ICTs to drive processes and privide innovative teaching skills to accommodate new generations of learners (Levinsen, 2011:52). Furthermore, if ICTs are successfully used, it helps teachers link technology with their knowledge of pedagogy, content and context (Hunde & Tacconi, 2014:719).

As discussed earlier in this chapter the teachers in the twenty-first century assume a new role of a facilitator who is expected to assist learners to achieve educational goals that are considered indispensable in the knowledge society (UNESCO, 2012:6). According to the constructivist paradigm, the role of the teacher is to actively engage learners in problem-solving activities thereby helping them apply higher-order thinking skills in innovative and creative ways. In this regard, the teacher also assumes the role of being a co-learner and lifelong learner. The teacher should contribute to teacher development programmes and share knowledge with colleagues through social network forums (Uche, Kaegon & Okata, 2016: 90). Digital generation transforms teaching and helps learners interact and multitask with ease. Children in the twenty-first century tend to be more comfortable using the keyboard for writing than writing in a book. Similarly, they enjoy reading from a screen rather than a book (Padayachee, 2017:41). Livingstone (2012:11) explained that these learners are connected all the time and anywhere. It is believed the availability of the internet brings about a widespread sharing of valuable resources while simultaneously paving way for collaborative learning (Padayachee, 2017:41).

Learners in the digital age require teachers who can meet all their needs and help them achieve their individual potential. For this to materialise, there is a need for teachers to employ teaching skills that enable learners to solve complex problems and acquire essential skills to improve their performance in schools. Teachers in the twenty-first century need to be prepared for a technology-rich future that could help them tackle educational problems and generate scientific and technological information that can be transferred into the demands of the world (Mormina, 2019:671). Therefore, if teachers need to keep up with change, they need to adopt new effective strategies to develop and align lessons using new technologies (Zungu, 2022:21). Aguti (2016:1-2) concurred that, in the twenty-first century, teachers have an obligation to introduce ICT skills to learners from the primary school phase that will prepare them for the job market. Therefore, the teachers must have ICT integration and digital competences.

Tedla (2012:199) states that ICT integration helps teachers meet the expectations imposed on them. Hinostroza (2018:99) further argues that various technological tools can help them create more learner-centred environments and make a positive difference in learners' learning and achievement even outside the classroom. Other research findings have revealed that, as a teaching tool in the classroom, ICT provides teachers with many opportunities. Simultaneously, it helps learners to understand what they are taught. ICTs also help teachers to achieve their educational goals (Sipilä, 2014:3), and play a vital role in teaching problematic subjects such as science and mathematics. The use of ICTs in complex subjects helps learners master important concepts and processes required (Shin, Sutherland, Norris & Soloway, 2012:551). Using ICTs also helps teachers to provide fast and accurate feedback to learners thereby assisting the learners to engage in active learning strategies for better understanding and good performance (Kafyulilo & Keengwe, 2013:3).

2.5 ICT AND ITS IMPACT ON LEARNING IN THE TWENTY-FIRST CENTURY

It is the responsibility of the learner to use ICTs for effective engagement in the learning process. Similarly, the introduction of ICTs in education has impacted on the teaching and learning process significantly and can enhance learner attainment and educational outcomes. The introduction of ICTs has caused a shift from previously commonly used learning methods like rote learning to interactivity and enhanced authentic, anchored, virtual and collaborative learning (Futuroti, 2022:70). For example, the 2020 COVID-19 pandemic caught us unawares and caused considerable unprecedented challenges forcing teachers to use online teaching platforms (König, Jäger-Biela & Glutsch, 2020:608). However, the use of ICTs in learning was well received by the type of learners that are found in the new information age era who have all the technological gadgets and the internet at their exposal. The internet plays a major role in their learning, relationships with friends, family members and communities (König et al., 2020: 608). In Turkey, Cavas et al. (2009:21) observed that Turkish learners use computers and the internet to interact with fellow learners to achieve their own learning needs and goals.

Although it is believed that most learners in South Africa use the internet to do research, find general information, social networking and to access quality and authentic learning material for their schoolwork or homework, Mdlongwa (2012:5) and Draper (2010:33) contend that this is hindered by the negative economic context and limited access to the internet in South African schools. Zungu (2022:14) concurred that the major drawback in use of ICTs for teaching and learning can be the lack of network connectivity in schools. However, Osman, El-Husein and Cronje (2010:19) believe that minus connectivity challenges, learners through mobile learning (m-learning), are able to access content instruction and information from anywhere as long as they are connected to the internet. This has huge benefits especially for distance learners since it avails learning opportunities to learners who are disadvantaged. By using smart phones, learners can engage in e-learning. This allows them to chat about schoolwork and share other school-related wireless messages with fellow learners daily.

Mayisela (2013:5) argues that when learners have missed class for one reason or another, social networks like Facebook provide learners with an opportunity to access missed coursework. Therefore, it is important that the GDE should embark on a massive project that ensures that all schools in the province, especially under-resourced secondary schools in Soweto, are equipped with free Wi-Fi. This could help learners benefit from the use of mobile technology. Admittedly, the Gauteng government has taken steps to provide free Wi-Fi in some parts of the province like the Tshwane free Wi-Fi project called project “Isizwe” (SA Government Online, 2015). The government did this to provide internet access to learners and residents in open public spaces for education and economic advancement purposes. However, the government has the responsibility to ensure that the project is intensified throughout the whole country. In the long run, this could enable all learners in South Africa to have access to the internet. This could help South Africa become competent in efficient use of technology in the twenty-first century (UNICEF, 2012:5).

2.6 EDUCATION AND POLICY CHANGES IN SOUTH AFRICA

Despite the education and policy changes that have taken place in South Africa since 1994, none of the policies has a direct bearing on the implementation of ICTs. However, it is important is to establish when these changes started to accommodate ICT implementation in schools. The next paragraph gives a brief history of education and policy changes that have taken place in South Africa since 1994 to establish when and how the changes accommodated the implementation of ICTs.

To keep pace with the transformation that was taking place in different sectors of the country’s economy after attaining democracy in 1994, the Department of Basic Education (DBE) saw it necessary to revamp the South African education system by introducing Curriculum 2005 (C2005). This gave birth to outcomes-based education (OBE) in the General Education Training (GET) band in 1997 targeted to ensure full implementation in Grade 12 by 2005. (Mouton, Louw & Strydom, 2012:110). By introducing OBE, the aim was to replace the race-based education system and provide an education system that would cater for all South African learners irrespective of race or socioeconomic background. The philosophy behind this new curriculum was to address skills, knowledge and values, and simultaneously promote learner-centred pedagogy through the introduction of an education system with specified critical outcomes, which included teamwork, problem-solving and critical thinking skills (Msila & Netshitangani, 2014:280; Sayed & Ahmed, 2011:110). However, despite high expectations that were pinned on OBE, it did not produce the intended results. Rather, OBE was deemed a failure because of the implementation problems that it had such as inadequate teacher development, the learning-at-own-pace principle that did not work and a complex policy (Mouton et al., 2012:214). Jansen (1997:5) had predicted that OBE would not succeed but fail as he argued that it was based on inaccurate assumptions about what happens in schools, organisation of classrooms and the types of teachers in the system.

The failure of OBE led to the review of C2005 which was replaced by the Revised National Curriculum Statement (RNCS) in 2002 to have a clearer structure written in simpler and more understandable language (Maluleka, 2015:12). Maluleka argues that this was meant to promote social justice, conceptual coherence, equity and social development by developing creative, critical and problem-solving individuals. The introduction of the RNCS was an acknowledgement that the OBE's aims such as 'own pace' had failed to materialise. The danger that arose thereafter was because government leaders, teachers, parents and learners were no longer confident in state schools and favoured independent schools (Mouton et al., 2012:1215). To avoid a further crisis, the DBE introduced another curriculum, namely Curriculum and Assessment Policy Statement (CAPS) in 2011 with the aim of improving the quality of teaching and learning in schools (DBE, 2011:i). CAPS had its emphasis on content knowledge, curriculum structure pacing and sequencing, and commitment to active learning and environmental content in subjects. By introducing CAPS, policy makers and education authorities sought to ensure an effective education system, and a changed society that embraces democratic values (Msila & Netshitangani, 2014:281).

The introduction of two different curriculum reforms in South Africa within a short space of time did not bring the much-anticipated change. Instead, the reforms brought major challenges for teachers who never got to grips with the principles and methodologies that these reforms sought to introduce. The never-ending changes that have been introduced by the DBE have led to underperformance of teachers and learners (Chigona, Chigona & Davids, 2014:5). Despite these challenges, the stakeholders should keep on seeking quality education. South Africa needs educational innovations that provide teachers and learners expanded opportunities to be able to compete in global assessments that facilitate educational rankings. This can only be possible if South African teachers and learners become knowledgeable and competent in the use of ICTs. Learners should also be creative and innovative in order to be producers rather than consumers of knowledge.

In May 2015, the Member of the Executive Council (MEC) for GDE, Mr Panyaza Lusifi emphasised the importance of having every teacher and learner use tablets in all Gauteng schools. This was driven by the GDE's recognition that ICTs in the information age have a role and potential to improve learner performance in schools and prepare them for future careers. However, research findings have shown that the provision of ICT resources on its own cannot guarantee the enhancement of teaching and learning (Zungu, 2022:82). There is a need to thoroughly equip teachers with ICT skills to integrate them into their pedagogical knowledge. This means that including ICT in teacher training should take priority so that teachers can acquire the necessary ICT skills and integrate them in teaching and learning. For this reason, the DBE should address the problem of poor educational facilities, a lack of adequately trained teachers and poor academic performance in South African schools (Van der Berg, Taylor, Gustafsson, Spaull & Amstrong, 2011:2) believe that the idea of providing all schools and every learner with a tablet as well as educational software remains a utopian ideal especially in rural and disadvantaged black schools. The unfavourable conditions of the schools could prevent ICT integration (Mlitwa & Nonyane, 2008:11; Mooketsi & Chigona, 2014:7).

2.7 THE INTRODUCTION OF ICTS IN SOUTH AFRICAN SCHOOLS

The introduction of the White Paper on ICT education in August 2004 presented a framework for strategic, political, pedagogical and developmental facets of implementing ICT education in South Africa (DoE, 2004:17). As the DoE (2004:17) stipulated, the White Paper on e-Education was about transforming learning and teaching through ICT. The main objective was to ensure that every South African manager, educator and learner in the further education and training band would be ICT proficient by 2013. Even though the introduction of ICTs in South African schools was the government's priority, it was not comprehensive and sudden, but rather incremental in nature. On the other hand, the South African education sector faced a major challenge of inequality when it came to provision of ICTs in schools (Zikhali, 2018:23). This a major problem in South Africa because the top 1% of South Africans own 70.9% of the country's wealth and the bottom 60% only controls a mere 7% of the country's assets (World Bank Group, 2018). Consequently, more than 55.5% or 30 million people live below the national poverty line of R992 per month and the most affected being black South Africans

(Zikhali, 2018:23). For this reason, they make up a bigger number of the unemployed, the less-educated, female-headed households, large families and children. Therefore, in introducing ICTs in an unequal society like South Africa, there is always a higher chance that these ICTs will only be enjoyed by a few which are the wealthy, and the poor will be left behind (Kayemba & Nel, 2019:79).

There is no consensus in literature about the impact of ICT on teaching and learning (Mooketsi & Chigona, 2014:2). Although Vandeyar (2015:348) maintained that there many studies on the challenges of ICT integration in South Africa, studies on the practical enforcement of e-Education policy escaped the focus of researchers. There is a need for studies that can help with the enforcement of ICTs in schools (Padayachee, 2017:36). ICT integration in education in South African schools was severely hampered by operational challenges, strategic and pedagogical challenges. In the snap survey carried out by Padayachee (2017:36) on ICT integration in South Africa, it was established that the uptake of technology in schools remained low. The study also established that the frequency of use per tool was as follows: contextual tools (41%), sharing information (29%), experiential tools (26%) and reflective dialogue tools (18%) (Padayachee, 2017:36). Furthermore, the study found that most teachers did not have ICT infrastructure or the necessary skills. This made the teachers uncertain about the enforcement of ICT education I their respective schools.

Prior to the snap survey by Padayachee in 2017, the National Education Collaboration Trust (NECT) in 2016 had also released a report regarding the state of ICTs in the South African Education system (Meyer & Gent, 2016:1). The report looked at the role of education, best practice and critical success factors; where we are now, the pathway to progress and the conclusion. By looking at all these focus areas, light was shed on the state of ICTs in South Africa. The introduction and provision of ICTs in South African Education was carried out by many players although at times it was done in a fragmented manner (NECT, 2016:2). The players included research institutions, solution providers, provincial and national Departments of Education and NGOs.

This study focuses on the snap survey by Padayachee in 2017, which had a sample of purposively selected teachers across all disciplines from selected (n=34) secondary schools in Tshwane South. The sampling process targeted schools with a confluence of relatively high access to the internet and top performing secondary schools to best represent ICT integration in education in South Africa. Most of the teachers who took part in the study were mostly involved in languages and Creative Arts. 78% of the participants were females. A large proportion of the teachers were in a possession of a first degree while a few had obtained master's degrees. The qualifications of the participants were as follows: diploma (n=24), first degree (n=57), honours (n=24), masters (n=7) and none (n=1).

Table 2.2 shows the summarised relative use frequency and relative importance of contextual tools.

Table 2.2: The relative use frequency and relative importance of context tools

Software tools	Relative Frequency	Relative Importance
Interactive whiteboards (e.g. SmartBoards)	10%	45%
Direct access electronic resources (e.g. CDROM)	30%	39%
Remote access electronic resources	33%	39%
Bring your own device (smartphones, tablets, etc.)	62%	62%
Data projectors	69%	80%

Adopted from Padayachee 2017

It is evident from the table that the least frequently used tools are the interactive whiteboards while the tools that are used the most are data projectors and Bring Your Own Devices (BYOD). Therefore, data projectors and BYODs were ranked as relatively important tools while direct access tools and remote access tools were regarded as the least important (Padayachee, 2017:45).

As reflected in Table 2.3, the most frequently used tools were search engines while the least used tools were qualitative analysis tools for research purposes and virtual laboratories.

Table 2.3: The relative use frequency and relative importance of experiential tools

Software tools	Relative Frequency	Relative Importance
Software for qualitative text analysis (e.g. MaxQDA)	4%	15%
Virtual labs (i.e. interactive simulations in which students perform experiments)	4%	28%
Software referencing packages (e.g. Endnote, RefWorks)	6%	16%
E-Portfolios	8%	18%
Statistical software (e.g. SPSS/PASW)	9%	24%
Computer simulations	9%	32%
Educational computer games	11%	32%
Graphic software (e.g. Photoshop, Flash)	17%	28%
Online examinations/tests	22%	46%
Internet-based learning platform (e.g. ANGEL, Moodle, Blackboard)	28%	27%
Multimedia-based learning software	34%	39%
Free multimedia-based learning software from the internet (e.g. simulations, animations)	37%	39%
Spreadsheet software (e.g. Excel)	83%	78%
Search engines (e.g. Google)	89%	84%

Adopted from Padayachee (2017)

It also evident that the spreadsheet software is also commonly used maybe because it is a prerequisite. Data also showed that most of the tools received a low-level response. Therefore, the internet and Google search were used habitually while the other tools were not frequently used.

Data in Table 2.4 shows that the most frequently used tools in schools that were part of the study were word processing and presentation type software.

Table 2.4: The relative use frequency and reletive importance of 'sharing information and ideas' tools

Software tools	Relative Frequency	Relative Importance
Audio software (e.g. Audacity, GarageBand)	4%	21%
Podcasts/Vodcasts (e.g. via iTunes)	6%	11%
Video editing software (e.g. Final Cut, Movie Maker, iMovie)	8%	23%
Self-created websites (e.g. Google Sites)	12%	20%
Online library services	18%	34%
Video/record lessons	25%	40%
Downloadable eBooks and electronic texts	25%	44%
File sharing (e.g. Dropbox)	28%	44%
Online video sharing sites (e.g. YouTube)	37%	54%
Presentation software (e.g. PowerPoint)	70%	79%
Word-processing programs (e.g. Microsoft Word)	83%	82%

Adopted from Padayachee 2017

The less frequently used tools according to the same data were audio software, podcasts/vodcasts, video editing software and self-created websites.

Data in Table 2.5 show that teachers appear to have high level of awareness when it comes the use of mobile learning tools, learning application and social media. However, when it came to the use of 3D virtual worlds, teachers seem to have the least level of awareness.

Table 2.5: The relative use frequency and relative importance of reflective dialogue tools

Software Tools	Relative frequency	Relative importance
3D virtual worlds (e.g. Second Life)	1%	17%
Virtual seminars/webinars	3%	16%
Class wiki (a website on which the pages can be edited by the learners)	4%	23%
Online slide sharing community (e.g. Slideshare)	7%	26%
Blogs (e.g. WordPress)	11%	22%
Collaborative project tools (e.g. wikis, Google Docs)	11%	18%
Online internal forums/newsgroups	11%	21%
Mailing lists	28%	34%
Social media (e.g. Twitter, Facebook)	42%	36%
Mobile learning tools and applications (SMS, WhatsApp etc.)	61%	61%

Adopted from Padayachee 2017

Therefore, the most frequently used tools were mobile learning tools, applications and social media, while the least frequently used tools were the 3D virtual worlds. In conclusion, the study revealed clearly that ICT challenges not only lie with how to use the technology but also how the ICTs are effectively integrated into the curriculum. Furthermore, the snap survey helps us understand the current ICT status in South Africa which is discussed in detail in Section 2.8.

2.8 THE CURRENT STATUS OF ICT IN SOUTH AFRICAN SCHOOLS

Although it was established in the snap survey by Padayachee that most teachers use ICTs for administration, lesson preparation, for research purpose, emailing and sharing files, challenges were also revealed (Padayachee, 2017:51). ICT integration in South African schools has shown that it has been severely limited by operational, strategic and pedagogic challenges. The principal challenges were the lack of infrastructure, internet connectivity in classrooms, lack of teachers' ICT skills and lack of funding (Tigere, 2020:116). The snap survey on ICT by Padayachee revealed that there is scant information on the practical enforcement of ICTs in the classroom and that the uptake of technology remains low. Teachers are uncertain about the enforcement of e-education and are encumbered by poor infrastructure and a lack of skills (Padayachee, 2017:36). On the other hand, not all learners are digitally literate and do not have access to devices such as tablets and mobile phones. Adukaite, van Zyl and Cantoni (2017:172) and Nyathi (2022:77) conceded that technology-enhanced learning has not advanced as far in South Africa as predicted. Furthermore, there are still disparities between the government expectations and teachers' practices. Since the explorative studies on the practical enforcement of e-education policy seemed to have escaped the focus of academic researchers, there is a need for studies that expose enforcement issues to improve teacher training in ICT integration. Although South Africa has an ICT policy, it is not comprehensive and this creates a barrier for ICT integration into the education system. Moreover, legislative provisions are scattered throughout government departments (South African Information Technology Industry Strategy [SAITIS], 2002:14). The general view is that the absence of such a comprehensive policy is not caused by a lack of political will, but it is an indication of the speed with which developments occur in the sector and the complexity of the issues involved (Ngobe, 2023:52). However, all these issues have the potential to create conflict and distract the government from pursuing a universal approach to ICT integration in South Africa (Mbada & Fourie, 2020:751).

In the context of the above, the approach to the education sector needs to be reviewed. This is important to prevent the South African Government from inadvertently creating a digital divide. Therefore, the South African government has an obligation to make sure that access to quality communications services, technologies, infrastructure and content is not a privilege of the elite, but a right for all (Department of Communications, 2013:10). Furthermore, it will serve as an example of visionary and enabling policy development and implementation (Ngcaba, 2012:8). This is significant as there is a pressing need for universities and the government to develop the ICT elements of pedagogic practice to train teachers effectively (Padayachee, 2017:51). Although the NDP proposed an integrated ICT legislative and policy framework, the provision of ICT remains the responsibility of the Department of Communications (Padayachee, 2017:51). However, various government departments are still directly responsible for enacting their own policies, including the DBE (Ngcaba, 2012:8). According to Mwapwele, Marais, Dlamini and Biljon (2019:2), the current guidelines provide very little information on how teachers and schools are expected to practically integrate or make use of ICT. There is a need for more qualitative studies to obtain a nuanced picture of computer use (Mfuphi, 2020:133; Smith & Hardman, 2014:22). This would help address the paucity of literature in the field of ICT use in South African schools (Adukaite, van Zyl, Er & Cantoni, 2017; Matyila, 2019:185).

A comparable study by Ndlovu (2016) on the pedagogical value of ICT integration by South African secondary school teachers revealed that many teachers did not know exactly what was expected of them in integrating ICTs. This is because the guidelines were not clear on the teacher’s role in ICT integration (Plessis & Webb, 2012:46). Another study by Adu (2016:1747) that sought to ascertain the use of e-learning facilities by the Economic and Management Science teachers in secondary schools in the Eastern Cape Province found that most digital tools, such as access to the internet, web-based learning, e-mail facilities and multimedia projectors were not available in schools. However, the study focused more on the devices than on a broad range of software tools that are available for teaching and learning. For this reason, not many teachers can effectively integrate ICTs in the classroom (Chisango, Marongwe, Mtsi & Matydi, 2020:15; Nkula & Krauss, 2015:3; Padayachee, 2017:38).

Despite the ICTs being used in the classroom, studies have shown that there is a need for more in-depth knowledge on the categories of technologies used and how these facilitate pedagogy and content knowledge. Previous studies revealed teachers’ lack of self-efficacy and misconceptions as the reasons why they do not use ICTs in the classroom (Nkula & Krauss, 2015:3). Teachers have misconceptions that by simply putting this technology in the hands of students, educational access issues would be resolved and educational transformation would occur. However, this is not true because there several factors negate the use of ICTs in the classroom, which include a lack of time, a lack of clarity regarding the e-Education policy, a lack of support both in terms of infrastructure and policy and a lack of skills (Ngobe, 2023:52). It is clear, therefore, that the challenge does not only lie with how to use the technology, but also with how to integrate digital technologies effectively into the curriculum.

Despite some of the challenges outlined above, the benefits of using ICT in teaching and learning far outweigh the challenges. Therefore, if ICT is implemented properly in schools, learners and teachers can reap many benefits (Shuro, 2020:59). For learners, these include increased motivation, increased active participation/creativity, improved knowledge and skills, increased responsibility and self-esteem and increased collaboration. Similarly, the ICTs also have several administrative advantages if properly implemented, which include accessing learners’ records, orderly record-keeping, and easy and effective communication in schools (Mhlanga & Moloi, 2020:9).

Furthermore, according to the e-learning Africa Report (Global System for Mobile Communications Association, 2012) from a survey which was completed by 447 respondents on the e-learning experience in Africa in a period of five years, ICT has many benefits in teaching and learning. The report was also the first of its kind in bringing together the views of e-learning professionals and a range of other stakeholders from across 41 African countries. The following benefits of ICT were identified in the report:

i. ICT motivates learners to learn.

ii. ICT makes distance learning easier.

iii. ICT makes learning more fun.

iv. Learners learn more independently, when they are guided appropriately by teachers.

v. Learners produced knowledge themselves.

vi. ICT helps to make more content available to learners via the internet.

vii. Through ICT, learners are connected to experts and have access to quality learning material.

viii. Learners show a better understanding of topics under study (Mdlongwa, 2012:5).

From the study conducted at Pearson High School in Port Elizabeth, Mdlongwa (2012:5) noted that learners echoed the sentiments expressed above. From the same study, teachers also pointed out the following benefits of using ICT in teaching and learning:

i. ICT helps to improve one’s knowledge and standard of work.

ii. ICT makes communication easier and faster.

iii. Learners acquire a variety of skills, especially typing skills and skills in Microsoft Word, Access and Excel programmes.

iv. Information is easier to get from the internet.

v. ICT improves learners’ research and project management skills.

vi. Learning is made easier and much more fun and interesting through ICT.

vii. Learners acquire skills which they could use beyond school at the university or workplace.

viii. Administrative tasks such as keeping files and registers of learners are much easier.

ix. The use of projectors helps to visually stimulate learners by showing practical real-life situations, especially in subjects such as geography and science.

x. Learners could learn more and practise more through the use social media (Mdlongwa, 2012:5).

The above-mentioned points indicate that the benefits of using ICTs in schools are immense. It is important, therefore, that all stakeholders in the South African education system, such as the government, the private sector, teachers, learners, school principals and society, should combine their efforts to ensure that ICTs are used effectively to improve teacher and learner performance in schools. The focus must not only be on making South African schools globally relevant based on the knowledge economy, but individuals must also be assisted to have a comparative advantage in coping with and competing in the changing and demanding twenty first century using ICTs.

2.8.1 Current ICT Strategy and Policy in South Africa

There has been some progress in school administration and provision of teaching and learning in South Africa even though the impact was compromised due to slow and uncoordinated implementation (Amory, Rahiman & Mhlanga, 2015: 1116; Makaring, 2023:5). According to Marais (2021:169), a lack of readiness, unreliable connectivity, teachers' lack of ICT skills and limited learner access to ICTs are major barriers to e-readiness in South Africa. There is also no clear, context-sensitive definition of objectives, no integrative strategy, no clear prioritisation within the constraints of the budget, and a tendency to use an unfeasible one-size-fits-all approach, which does not recognise the diversity of South African schools (Amory et al., 2015). In addition to the policies that are specific to ICT in education, the implementation of ICT in schools is also influenced by the broader regulatory environment, including financial and administrative policies. One of these policies is the Free-on-Open software policy or the National Broadband policy, which is used by the South African Government (DBE, 2012:2013). There are also other education-specific policies such as the Guidelines Relating to Planning for Public-School Infrastructure and the Integration Strategies Planning Framework for Teacher Education and Development in South Africa 2011-2025 (DHET, 2012).

The general concerns about ICT education are that, while the policy environment has been defined at a high level, the implementation is slow and uncoordinated. Specific resources and capacity are also insufficient to ensure successful implementation. Furthermore, the objectives of ICT in education are articulated in general terms and do not translate into practical pathways that make them achievable. In practice, many initiatives are not clear about what must be achieved (Mfuphi, 2020:133; Ostrowick, 2016 cited in Meyer & Gent, 2016:13). In addition, many initiatives seek to improve learner performance, but are unable to define pathways of how to move from the current reality to future success.

Policy and strategy are defined at a high level, and do not extend across the education system. Furthermore, policy and strategy are not differentiated for context-specific solutions. Given this vacuum, leading provinces proceed to develop their own approaches, independent of the national initiatives. In addition, in the absence of clear guidelines and integrative strategies which are solution-driven for the implementation of ICTs in the education sector, the potential benefits of ICTs may remain untapped, and educational institutions may struggle to harness their full capabilities to enhance teaching and learning experiences (Arends, 2021:146; Meyer & Gent, 2016:13).

When it comes to the vision, policy and implementation, it has been established that there is an overall vacuum that leads to changes in the system directed by solution-providers. The current ICT policy implementation progress in education has been found to be limited and slow. Unlike most developed countries, South Africa does not have a comprehensive ICT policy (Shava, 2022:87). Legislative provisions are scattered throughout government departments (Leendertz, Blignaut, Nieuwoudt, Els & Ellis, 2013:7). Although Leendertz et al. (2013:7) are of the view that the absence of a comprehensive policy is the result of the speed with which development occurs in the education sector, Shava (2022:87) believes that this is caused by the government's lack of political will. Such a situation has the potential to create a conflict and distract the government from pursuing a universal approach to ICT integration in South Africa. The South African government, therefore, should review this fragmented approach so that it does not inadvertently create a digital divide (Shava, 2022:87). The National Development Plan (NDP) stipulates that the government should conduct a full policy review in the short term to develop a "new integrated policy" (Department of Communications, 2013:11).

Teacher professional development (TPD) has been identified as having a regulatory framework which, if followed, incorporation of ICT into the curriculum will be easy. However, there is no evidence that the regulatory framework is used to incorporate ICT into TPD. Since there is no national curriculum for TPD, the implementation is left to individual institutions and solution-providers. Therefore, the districts should develop the capacity to procure TPD services. In this sense, TPD can be conceptualised as an ongoing development programme that sits on a continuum of initial/pre-service to continuing/in-service training (Engida, 2011:17).

Training and awareness are required to ensure that ICTs are integrated in a phased manner to support pedagogy (Katemba, 2020:123). However, the training must have clear goals, as well as teacher and learner guidelines on how to use ICTs to support teaching and learning. This is important because the use of ICTs in education is not often supported as a teaching model. To avoid confusion, it is important to understand and manage progress made in ICT introduction and its benefits in teaching and learning clearly. In addition, the objectives of ICT integration should always seek to improve the standard of teaching and learning in the classroom. Furthermore, there is a need to ascertain if the use of ICTs has a positive impact on the teaching and learning process (Domalewska, 2014:28; Svendesen, 2020:111). The value of incorporating ICTs is not always clear to teachers, and it is not well addressed by the current programmes. Accordingly, teachers have a slower uptake of ICTs than learners, causing them to fear the changes that they bring. This is because teachers have different levels of ICT knowledge, and in general, most of them lack confidence in the use of ICTs to support teaching and learning (Nyhathi, 2022:25).

Regarding curriculum content, there is ample content available; however, it is of varying quality and could benefit from better coherence (Alnahdi, 2014:21; Alpher & Goggin, 2017:70). It is important that content should be in support of the curriculum and not the other way round. The DBE has made a considerable amount of content available, but mainly in the form of large, inaccurate caches. This is a big concern since it allows content providers to prescribe curriculum content that is not aligned with strategic objectives. Most content is not always open-source and sometimes requires licencing fees (HSRC, 2014:5). Although content is not a constraint, teachers find it difficult to engage with and use it to support teaching and learning in the classroom (HSRC, 2014:5).

As for assessment purposes, the power of ICTs appears to be under-utilised and its role undervalued (Amory et al., 2015:1116). Another challenge is that there is not much information on ICT assessment in South Africa. According to a 2006 study of assessment in 400 schools (Second Information Technology in Education Study (SITES) 2006), there was limited application of ICT for assessment. This was despite varied assessment practices and widespread use of ICTs in place in the schools (Amory, 2015:1116).

Regarding connectivity and hardware, it has been established that there is unequal access and distribution of ICTs across provinces and school quintiles (Ostrowick, 2016:14). Research has established that about 15% of schools have full access to computers, 22.6% have access to computers for teaching and learning; 80% of schools in Gauteng have a computer laboratory, Quintile 5 schools in Gauteng are better resourced and that access is currently mostly limited to Quintile 3 and higher, and about 58.8% of schools have access to computers for administration (Amory, 2015; 1116; KPMG, 2009; Ostrowick, 2016; Welch, 2010). With respect to connectivity, it has been established that slow speeds and high costs contribute to slow uptake (DoE, 2004; HSRC, 2014; SAIDE, 2010). The broadband is also unstable and expensive. Connectivity in rural areas at broadband speed is lacking, which hampers the delivery of high-quality content (Amory, 2015:1116). The costs of WLANs are very high, videos require high bandwidth and there is a need to control access to inappropriate websites. Ongoing support and maintenance costs which include training, technology support and device replacement are high (Amory, 2015:1116). It was also established that there is a need for a clear exit strategy that enables capacity and transfer of all projects to the DBE. Although partnerships are useful in rolling out infrastructure, they are not adequately coordinated, and state-owned enterprises adopt duplicated and conflicting roles (Amory, 2015:1116).

As for management and administration at the school level and in provinces, studies revealed that there is a lack of integration of ICT into the organisational cultures of schools and districts (Amory, 2015:1116). School management teams make little use of ICTs when executing their duties. Teachers and principals are isolated from the district e-learning units, leading to superficial knowledge of the e-education policy and incoherent actions. While the South African School Administration and Management System (SA-SAMS) has improved data capturing at the school level, the functionality of the system is under-utilised since most of the time it is not web-enabled, which means that data collection is costly and inefficient. (Ostrowick, 2016:14) Therefore, accuracy and data completeness are poor. Staff at the school and district levels have limited opportunities to access data on the system and its reliability is questionable. The ongoing technical support for SA-SAMS is lacking in most schools leading to some choosing to use other systems, even when these come at a cost. However, the Data-Driven Districts Programme helps to develop a customised data collection process, a sustainable data collection system, better defined ownership of data, and improved data quality (Ostrowick, 2016:14).

2.9 GOVERNMENT INVESTMENT IN ICT INITIATIVES AND PROJECTS IN SOUTH AFRICAN SCHOOLS

The Government of South Africa through the DBE acknowledges the need to improve the quality of education. It admits that the quality of education in the country is below international standards and that there is a need for collaborative efforts to improve it (DBE, 2007). This was evident in the Trends in International Mathematics and Science Study (TIMSS) conducted in 2011, which revealed the mediocracy of education in South Africa (Spaull, 2013:368). The study compared how learners from different countries fared in the subjects of mathematics and science (Reddy, Visser, Winnaar, Arends, Juan, Prinsloo & Isdale, 2016:2). The study revealed that learners from South Africa had the lowest performance from the 21 middle-income countries that took part in the study (Centre of Development and Enterprise, 2013:1). The study showed that mathematics had a score of 352 while science had a score of 332 (HRSC, 2012:4), which was way below the average achievement scale for TIMSS set at a centre point of 500 (Reddy et al., 2016:2). Another TIMSS study carried out by the HRSC in 2015 on Grade 9 learners revealed that mathematics had improved to 372 scores and science to 358 scores (Reddy et al., 2016:2). When the results were further analysed by Reddy et al. (2016:2), only 34% of learners achieved a score of over 400 in mathematics and only 32% of the learners achieved a score of over 400 in science. This indicates that three-quarters of Grade 9 learners did not achieve the minimal level in mathematics and science in South Africa, which shows that the South African education system is poor (Meyer & Gent, 2016:4).

The quality of teacher education and professional courses that teachers undertake has a direct bearing on the quality of education in schools. Therefore, teachers should know that they have control over the teaching and learning environments and what is taught. Empowered with this knowledge, teachers need to improve their skills and knowledge of the subject content (Isaacs, 2007:429). In this context, South African government, through the DBE initiated several ICT projects discussed below in an attempt to improve the quality of teaching and learning in schools (Isaacs, 2007:429).

2.9.1 The Khanya Project

The Khanya Project was started in the Western Cape Province in 2001 as a provincial programme to address the lack of ICT skills among teachers and sought to rectify it by making by promoting the use of technology for teaching by teachers (Western Cape Department of Education (WCED), 2014:23). It also sought to enable teachers to teach subject content through technology (WCED, 2014:23). The WCED installed computer facilities in schools to train teachers on how to use ICTs in order to improve teaching and learning (Rahimi, Beer & Sewchurran, 2012:615). Disadvantaged schools were targeted in this project to bridge the digital divide between poor and rich schools. Furthermore, the project needed to promote optimal use of ICTs by community members, teachers and learners (Rahimi et al., 2012:615). The Khanya project analysed whether the use of ICTs for teaching mathematics had an impact in schools. Using control and experimental schools, this longitudinal study conducted by the University of Cape Town lecturers investigated how the use of the ICT-based master mathematics programme had a bearing on standardised mathematics scores of learners (Wagner, Day, James, Kozma, Miller & Unwin, 2005:30). Experimental schools were revealed to the ICT-based Master Mathematics programme which was used to teach mathematics. For the control schools, the ICT-based Master Mathematics programme was not administered. The results from the study revealed something significant. The experimental schools which were exposed to the ICT-based Master mathematics programme showed that the scores of the learners were significantly higher than those of control schools where the ICT-based Master Mathematics was not administered (Wagner et al., 2005:30). From these results, one can conclude that the use of ICTs in teaching and learning can improve learner performance.

The other goal of the project which was to empower all teachers in the Western Cape by year 2012 was rather ambitious. Rahimi et al. (2012:615) concurred that the goal was ambitious considering other factors which hamper the adoption of ICTs in schools. These factors include, among other things, learners and teachers' skills in technology, and teachers' attitudes towards technology. These factors have already been explained in detail in the previous paragraphs.

2.9.2 Thutong Portal

The Department of Education in collaboration with provincial education departments and other stakeholders developed the Thutong Portal in 2005 (Isaacs, 2007:429). The name Thutong is derived from Setswana language meaning the "place of learning". The portal comprises a database with annotated curriculum-based resources covering all the subjects (Brand South

Africa, 2012). The idea behind the launch of the Thutong portal was to make sure that teachers, learners, parents and school managers can access syllabi and all other relevant educational material. The portal also focuses on the creation online communities to enable users to connect and share subject-related information with subject experts and peers within and outside the country (Isaacs, 2007:429). The portal offers free service to registered users, affords them access to valuable subject resources and exposes users to lifelong learning (Brand South Africa, 2012).

2.9.3 Intel® Teach

Intel® Teach is a professional development programme that is used by the South African Council for Educators (SACE) (Isaacs, 2007:429). It was developed to prepare teachers and learners to use ICTs for teaching and learning competently (Isaacs, 2007:429). We live in a knowledge economy that demands learners and teachers to be independent lifelong learners. For this reason, Intel® Teach was established to ensure that teachers are intensively trained so that they can use modern ICTs in their classrooms effectively. The programme does not merely focus on teaching participants how to use computers, but also how, when and where to incorporate ICTs in the teaching and learning process (Letseka, Letseka & Pitsoe, 2018:1). Teachers were trained in their respective schools by experienced and skilled facilitators. This project of training teachers was run by SchoolNet SA and funded by either the provincial government or by the schools themselves. The idea was that teachers who progressed in the Intel® Teach modules would in turn collaborate with other teachers and share ideas on the good practices of using ICTs in the classroom (Letseka et al., 2018:1).

To find out whether the programme was effective, Wilson and Thomson (2005:71) conducted a study, which revealed that not all the teachers who completed the Intel® Teach programme used ICTs for teaching and learning. This was reflected in the results from the sample that was used. The results from this sample showed that about 48.5% of teachers used ICTs in lessons at least once a month, while 28.8% of the teachers did not use the ICTs at all in the lessons (HSRC, 2005:108). Another finding from the study was that, of the 48.5% of the teachers who did not use ICTs in their lessons, most were from rural schools. This was attributed to a lack of facilities, large classes and many other factors that affected rural schoolteachers (HSRC, 2005:108).

2.9.4 The Rollout of Tablets to Learners in Gauteng Schools

The rollout of tablets to learners in Gauteng schools was inspired by the GDE's plan of start a paperless classroom project in 2015 (Sayed & Motala, 2012:672). The paperless project is all about the use of smart boards and tablets connected to the internet. The tablets were to be pre-loaded with relevant e-learning content and then distributed to learners. The smart boards were also installed in the classrooms (Meyer & Gent, 2016:1). No-fee paying schools were targeted. The schools were targeted because they are some of the poorest schools in South Africa and allowed learners to enrol without paying fees (Sayed & Motala, 2012:672). These schools are subsidised by the government and given larger amounts of funding from the fiscus. The money is given per learner to make up for the fees charged by different schools (DBE, 2017). Such schools are mostly located in disadvantaged communities like the townships and rural areas.

Although the goals of this project were good and sought to improve the quality of education in the different schools, the project faced various setbacks. These included issues of burglary where schools were broken into, vandalism of ICTs and connectivity issues (Czemowalow, 2015:1), which disrupted the running of schools. These prompted the MEC for education in Gauteng, Mr Panyaza Lesufi to recall the tablets to give the department time to tighten security at schools (Czemowalow, 2005:1). However, the recall had its own repercussions on the teaching and learning as learners were disconnected from the internet and e-learning content, which disrupted their learning. On the other hand, teachers were also affected and had to resort to traditional teaching methods (Raman & Yamat, 2014:11). Consequently, in response to the recall, the shadow Deputy Minister of Basic Education for the opposition party, the Democratic Alliance (DA), Ms Desirée van der Walt, highlighted other challenges that were faced by the rollout of technology and e-learning in South Africa (Czernowalow, 2015). She noted that teachers had limited ICT skills and there was a lack of information technology (IT) specialists in schools to assist teachers facing technical challenges. A study by Kabe, Kalema and Motjolopane (2015:1326) in the Tshwane District confirmed van der Walt's claims that providing ICT facilities to schools and implementing projects like Gauteng online project did not benefit e-learning much. This was due to a lack of skills of teachers and a shortage of trained ICT facilitators. Furthermore, the rollout of technology in South Africa at the national level was also fragmented. Consequently, the government's plan to provide all the schools with broadband access was a not a realised due to the discrepancies in budget allocation for provinces (Meyer & Gent, 2016:1). Because of budget constraints in different provinces, only a few that prioritised the use of ICTs in teaching and learning such as Gauteng Province and the Western Cape, took the lead in the implementation of ICTs in their schools (Meyer & Gent, 2016:1).

2.9.5 Teacher Laptop Initiative for Gauteng School Teachers

The Teacher Laptop project commenced in 2008 managed by the Education Labour Relations Council (ELRC) (Tubbs, 2013:1). The DoE initiated the project with the belief that if teachers and learners are provided with resources, the quality of education would improve. Teachers at public schools were targeted with the aim of providing them with laptops by 2011 (Naidoo and Rasool, 2021:14). Teachers who qualified for the laptops were given an ICT package which included a laptop, national curriculum software and internet connectivity with a monthly allowance of R130 for a period of five years (Government of South Africa, 2010:1; Tubbs, 2013:1).

Due to funding problems, the project stopped somewhere along the way, and it was ultimately discontinued (Mzekandaba, 2015:1; Tubbs 2013). Nevertheless, the then Deputy Minister of Telecommunications and Postal Services, Prof Hlengiwe Mkhize argued that teachers needed more training on the use of these ICTs (Mzekandaba, 2015:2). She asserted that giving teachers the ICT equipment without training them on how to use it was a futile exercise (Mzekandaba, 2015:2). Similarly, Macupe (2017:1) noted that teachers who were given laptops in the Mount fletcher and Bizana districts in the Eastern Cape conceded that they had never used ICTs for teaching and learning before and were not even trained on how to use them. Therefore, it can be concluded that the ICT project was not a success because teachers were not equipped with the necessary skills before the rollout could be initiated.

2.10 ICT IMPLEMENTATION PROJECTION BY SOUTH AFRICA

All the stakeholders involved in the implementation of ICTs in education in South Africa should know that introducing them in schools can improve teacher and learner productivity and the quality of education. Mou and Rajib (2019:99) argued that introducing ICTs in schools promotes online learning while improving interactions between teachers and learners. They further argue that the use of ICTs in schools enables teachers to offer support to learners using online platforms. UNESCO (2002:3) concurred that the introduction of ICTs in schools has made it possible to teach more subjects at a distance thus promoting distance learning. Furthermore, research has proven that the use of ICTs in schools help eliminate several learning barriers (Mou & Rajib, 2019:99). For some time, the DBE has been changing its traditional practices in teaching and learning and replacing them with technology to adjust to social changes. Moreover, there is an emerging worldwide consensus that use of ICTs in education has several benefits and that there is need to invest more in the training teachers' relevant ICT skills (Shagrir, 2017:331). Sun and Chen (2016:172) maintained that since the use of ICTs is new to both novice and experienced teachers, especially in Africa, there is a need for professional development. However, only investing in professional development is not enough, there is a need to also provide schools with institutional support. Hicks (2014:283) concurred that providing support to schools is a critical element in ensuring good teaching and learning practices. The institutional support can vary from the provision of ICT resources, ongoing training of teachers and ICT maintenance. However, for South Africa to achieve all the above, it must advocate for the awareness of pedagogical and technical expertise that teachers need to have. This is vital because South Africa aims to get to a point where ICTs become impactful in education. UNESCO (2011) pronounced that the role of ICT in education is to support the present-day knowledge society. To this end, South Africa strives to make sure that ICTs are relevant within the education system, support teaching and learning and support value creation. Therefore, it is fundamental for all relevant stakeholders to come up with well thought, proactive and continuous planning. The focus of ICTs should be to enhance the education process, pedagogy and teacher competency.

The fundamental objective of South Africa is to design solutions that are tailored to improve the teaching and learning in schools through ICTs. Although strategy and policy exist, implementation is slow, capacity is limited, objectives are not clear and the integration strategy across the system is lacking. Access to technology is limited and unequal across provinces and school quintiles (Denoon-Stevens & Ramaila, 2018:432). In the absence of clear, integrative provincial strategies, progress is fragmented and driven by solution-providers. South Africa aims to prioritise system-wide change management and establish ICT-enabled assessment. The emphasis is on developing long-term sustainability and the capacity of the education system to integrate ICTs in support of education needs. Consequently, the focus is to shift from learner performance to capacity development. This is only achievable when a phased approach, with appropriate interim targets, is put in place. The DBE wants to make sure that progress is measured against multiple criteria and focuses on measuring the capacity of the system to integrate technology, and the capacity of teachers to incorporate technology into the teaching and learning process (Amory, 2016:1116). This could only be possible by ensuring strategic alignment for ICT integration at all levels of the education system, increasing the focus on pedagogy in ICT initiatives, developing the skills, confidence and desire of teachers to integrate ICTs into teaching and learning, and focusing on sustainable interventions (Dube, 2018:88).

2.11 THE EMERGENCE OF ICT POLICIES IN EAST AFRICA

A review of ICT policies in East Africa sheds light on how other African countries responded to ICT education and policy changes, which is key to the successful implementation of ICTs in South Africa. It is argued that sustained technology intervention is enabled and supported by key stakeholders, especially the political will of African governments (Kimanzi, 2021:592).

East Africa is made up of six countries, namely Tanzania, Kenya, Burundi, South Sudan, Uganda and Rwanda, which collectively form the East African Community (EAC) (Karsenti, 2009:7). During the nineteenth and twentieth century, the region was destroyed by wars driven by competition between the colonial nations of the time (Karsenti, 2009:7). When power was eventually given back to the rulers by the colonial rulers, the subsequent independent states were rocked by political coups, civil strife, oppressive dictatorships, bad administration and ethnic violence which stagnated their development. This also had a devastating effect on the education system of the region (Mutonyi & Norton, 2007:264). The education sector was tremendously affected by the dwindling economy and subsequent poverty.

Faced with the above-mentioned challenges, East Africa decided to embrace technology as they viewed it to be an important agent for development. This is because the positive effects of the use of ICTs in developing countries were increasingly being noticed. Similarly, Africa saw the use of technology as a key to development. Karsenti (2009:7) notes that technology plays a critical role in development and advocated that African countries must adopt it to support their development efforts. However, Waema (2005:25) conceded that in many African countries, the emergence and use of ICTs has been hasty and haphazard. This necessitated reorganisation of some sectors. With the aid of donor agencies, by the turn of the millennium, the whole of East Africa managed to formulate ICT policies to deal with any anomalies that might arise in the implementation of ICTs in their countries' education systems. Toure (2009:94) noted that these early reforms were referred to as the "Draft National Policy" in Kenya (Ochuodho & Matuga, 2004:464). The rationale behind the development of ICT policies was to provide a set of goals and a vision of how the education systems needed to deal with the introduction of ICTs in teaching and learning. Another aim was to make sure that teachers, learners, parents and the general population benefited from these ICTs (Jung, 2003:39).

In East Africa, the formulation of national ICT policies was considered crucial within the education sector, as ICTs play a pivotal role in preparing students for the workplace (Were, Rubagiza, Denley & Sutherland, 2007:15). However, ICT policies in East Africa began to take shape in the early 2000s. Farrell and Isaacs (2007) observed that governments were prompted to regulate ICT policies as there had been an increase in unregulated use of ICTs in these countries. However, the initial ICT policies were not comprehensive and did not include all the sub-sectors of the education system (Hennessey, Onguko, Harison, Ang'ondi, Namalefe, Naseem & Wamakote, 2010:8). For example, in Kenya, the first ICT policy was drafted in the 1980s and completed by 2000 (Nduati & Bowman, 2005:56). The next section discusses how ICT policies were formed in East Africa. This is very important because a review of their emergence would shed light on how other African countries can handle them.

2.12 AN OVERVIEW OF ICT POLICIES IN EAST AFRICA

The success of ICTs in any country is backed by sound ICT policies. This is important because these policies serve several important functions. They guide and set goals and a vision of how the education system must operate. They also stipulate how learning should take place when using ICTs for the benefit of students, teachers, parents and the general public (Kozma, 2005:117). Education is one of the sectors that are highly influenced by technological developments. For this reason, all countries should revamp their educational systems and increase educational attainment to prepare for global technological change (Kozma, 2005:117). However, it is suggested that if ICTs are to produce results, there is a need to formulate sound ICT policies in education, which could guide the implementation of ICTs in schools. To understand the South African context, it is important to unpack what happened in other African countries. This study looked at how ICT policies are embedded in the national policies of some countries in East Africa. This was crucial since ICTs play an important role in preparing learners for the workplace (Hennessey et al., 2010:8). Therefore, it is also crucial to ensure that ICTs are carefully integrated into the education system. ICTs also have the potential to facilitate how learners acquire relevant life skills for the ever-changing economic and information order (Brown, 2005:299). The sections below discuss how ICTs have been implemented and how they have influenced some countries in East Africa.

2.12.1 The Rationale for the Introduction of ICTs in Tanzania

The development of ICT policy in Tanzania gave rise to the formation of a group called the eThinkTank (Twaakyondo et al., 2002:5). This was a forum supported by the United Nations

Development Programme (UNDP). According to Twaakyondo et al. (2002:5), the eThinkTank aimed at presenting to the public and Government ideas and suggestions that will assist the country with the transition into the information age. The other objective of eThink Tankwas was to be able to harmonise Tanzania's current ICT policies and the regulatory environment with other neighbouring states and other partner countries. The harmonising of the policy was expected to help develop and promote the teaching of ICTs in the country with the hope of ultimately improve the quality of education and training in all areas, including distance learning. This was going to be achieved through a nationwide deployment of an e-education system that interconnects all higher education institutions in the whole country (Ministry of Communications and Transport, 2003:13).

In 2003, the Tanzanian government published the national ICT policy which detailed set objectives related to the development and application of ICTs in education and training. Some of the objectives that had a bearing on the primary and secondary education include the following:

a) The expansion and development of the teaching of ICTs across all national education system including informal education and training.

b) Using ICTs in all sectors of the education system to improve the quality of education and training in order to enhance the learning.

c) The development and deployment of a nationwide interconnected e-education system to support all educational institutions across the country. This would be achieved by the introduction of relevant knowledge centres, the provision curriculum integration and generation of information that will better shape policies regarding ICTs (Ministry of Communications and Transport, 2003:13).

The introduction of the above-mentioned policy and other series of consultations by the Government of Tanzania, the Ministry of Education and Vocational Training (MoEVT) played a big role in developing an ICT policy for the Department of Education (Ngeze, 2017:424). The policy acknowledged that a few schools mainly in the urban areas were better off in terms of access and infrastructure. However, the aim of the policy was to ensure that the necessary infrastructure was established to facilitate ICT adoption in the education system, which was planned to cover all schools nationally by 2015. The idea was to implement this in partnership with the donor community to finance the rollout of ICTs in education (Ngeze, 2017:424).

2.12.1.1 Government investment in ICT initiatives primary and secondary schools in Tanzania

The investment landscape of ICT in Tanzania used a different approach to what other East African countries experienced. Some of the most notable approaches used by the Tanzanian government were the Education Information Management System (EMIS) and e-program (Hare, 2007:7). The Tanzanian government also prioritised the implementation of ICTs in teachers' colleges and the schools by making sure computers were provided. This was done with the main objective of improving the quality education (Hare, 2007:6).

The EMIS was a national project aimed at providing educational data based on six categories: baseline education statistics and demographics, information and assets, human resource information, school performance, financial management information and documents such as research and field reports and policies. (Tanzania, MoEC, 2004:1). The aims were to collect, process, use and disseminate education data to educational stakeholders promptly. Data from the MoEVT website was used to assess the achievement of the above intended goals (Ameko, Miheso & Ndeuthi, 2015:17).

The Tanzanian government was different from other East African countries in the sense that it chose to invest more in ICT curriculum development for primary schools even though its diffusion is still very limited to only a small number of urban schools. To make sure that this programme succeeded, the MoEVT had to partner with donor agencies in an effort to give teacher training colleges support in ICT programmes (Tanzania MoEVT, 2007:1). They equipped all the 32 colleges in the country with computers. Tutors in these colleges were given ICT training, which enabled them to acquire an International Computer Driving Licence (ICDL) (Ameko et al., 2015:17). However, it remains uncertain whether the approach had the desired impact on the adoption of ICTs in Tanzanian primary schools (Malero, Ismail & Manyilizu, 2015:2013).

Therefore, the Government of Tanzania was directly involved through a consortium of stakeholders, which included the private sector and NGOs helped to establish ICT infrastructure in secondary schools. However, at the primary school level, not much was documented in terms of government investment other than the development of the curriculum which did not necessarily enjoy much adoption (Ameko et al., 2015:1). The government mainly targeted teacher training colleges with the hope that teacher trainees would later use the ICT skills they acquired to implement the primary school curriculum effectively. Even with the EMIS in place and the school's demographic data available, it is still difficult to obtain data on the state of ICT infrastructure levels in Tanzanian schools. (Daudi & Nzilano, 2019:40) In addition, there is a dearth of research that assesses the impact of ICT investment versus the quality of teaching in Tanzanian schools, which makes it impossible really to show an accurate picture of ICT use in schools (Hennessey et al., 2010:24).

2.12.2 The Rationale for the Introduction of ICTs in Uganda

Prior to 2003, there was no clear framework to guide investment in ICT education in Uganda (Muweesi et al., 2021:173). In fact; schools came up with their own initiatives that were mainly funded by donors on bilateral terms. In 1998, the Uganda National Council of Science and Technology (UNCST) initiated the development of the country's national ICT policy (Nyakito & Role, 2018:1) The development of an ICT policy is important in any country because a policy plays a very important role of providing schools with clear guidance (Edinburgh Council, 2015:7). In 2002, five years after the implementation of national ICT policy, the UNCST submitted a draft national ICT policy framework to the cabinet, which was approved the following year 2003 (Nyakito & Role, 2018:1) Accordingly, Uganda was compelled to reorganise and embrace the goal of lifelong education for all because of this policy framework (Farrell, 2007:2). The policy aimed at improving literacy and human resource capacity building. It also sought to integrate ICTs in mainstream educational curriculum including other literacy programmes to provide equitable access for pupils and students at all levels (Uganda, Ministry of Works, 2003). Thereafter, the policy necessitated the formulation of an ICT policy for the education sector in 2005. It helped to rationalise and harmonise ICT-related activities and programmes within the education sector (MoES, 2005). It also advocated investing in ICTs right from primary to tertiary levels. Although ICT programmes were initiated at secondary and tertiary level, this was done on a limited scale compared to the demand for ICT services at these levels. It was pivotal for the government to partner with private sector on ICT provision to narrow the deficiency in student teacher computer ratio (Muweesi, Lou, Nakonde, Jerome, Tomusange & Sserwadda, 2021:174).

The Ugandan ICT policy defined various focus areas and guided how the government should invest in ICT, especially in primary and secondary schools. The policy encouraged primary schools to acquire technology they would use to support teaching. This was necessitated by producing teaching materials or using the technology with students. In addition, there were computer awareness programmes at primary teacher training level (colleges) to equip newly trained teachers on how to use ICTs when they finally become available in schools (UNESCO, 2015:11). At the secondary school level, the policy urged the government to have a more direct role and ensure that all teachers are well equipped in using ICTs for lesson preparations and for the teaching and learning process. In addition, an “ICT application subject” was introduced in secondary schools that had adequate ICT equipment e.g., computers, connectivity, overhead projectors and the like, just to mention a few. The policy also underscored the need to mitigate and address the digital divide that could rise between the wealthy urban schools and poor rural schools intensified by the expansion of ICT in schools (Hennessey et al., 2010:19).

2.12.2.1 Government investment in ICT initiatives primary and secondary schools in Uganda

The Ugandan government’s major investment in ICT for the educational sector was the Education Management Information System (EMIS) meant to provide quality education statistics on time, using cost-effective and sustainable methods. However, the government needed to make sure that the process of ICT integration was done according to the guidelines stipulated in the education ICT policy of the country. The school’s context also needed to be taken into consideration (Alikuraira, 2016:624). To achieve this, data was captured on school facilities where pupils’ details were uploaded to the system with everything being coordinated at the district level. Subsequently, data was then compiled and processed nationally (Alikuraira, 2016:623). For this process to be successful, districts were equipped with internet-connected computers together with associated peripherals and provided with trained officials. However, not much was achieved through this initiative as the MoES suspended its plans to network all districts with the central system to enable real time flow of information from the districts to the MoES headquarters and vice versa (Muweesi et al., 2021:173).

The MoES in partnership with certain agencies also supported other ICT initiatives. Some of these notable initiatives were the Microsoft Partners in Learning Program, SchoolNet, Curriculum Net, Connect-ED, Computers for schools Uganda, Cyber Schools’ Technology Solutions (CSTS) program and NEPAD e-schools’ initiative (Muweesi, Lou, Nakonde, Jerome, Tomusange & Sserwdda, 2021:174). The focus of the initiatives was to equip schools with computers and associated hardware and software, teacher training, internet connectivity, teacher training in ICTs and the selection and development of appropriate digital pedagogical content. However, there were other ambitious initiatives such as the Microsoft Partners in Learning Program which equipped about 100 schools with donated PCs. The initiative also intended to have about 8 000 secondary schools fully equipped with computers and training modules by the end of 2015 (Muweesi et al., 2021:175).

Despite all these initiatives by the Ugandan authorities, there is not enough information on their actual impact in schools (Bagarukayo, 2018:210). However, this is typical in many developing countries because most teachers are not fully ICT-literate (World Bank, 2016:75). Nevertheless, expects agree that Uganda lags behind when it comes to ICTs in education compared to other African countries (World Bank, 2016:75). Studies in Uganda have shown that there is still a gap between ICTs and the teaching and learning in the classroom since most teachers still lack ICT skills (Nakintu, & Neema-Abooki, 2015:8). These findings make one wonder how ready Ugandan teachers are to embrace the new technologies in the schools. For this reason, the MoES in collaboration with Uganda Communications Commission advocated the establishment of ICT laboratories in over 1 027 secondary schools to enhance ICT use and integration in schools (Namae, 2020:6). However, the initiative suffered a setback when most schools especially those in the rural areas had a shortage of ICT qualified teachers, lack of computers and electricity (Namae, 2020:6). Furthermore, Ndiwalana and Tusubira (2012:4) cited the unavailability of effective ICT policies to guide the shift from the traditional teaching and learning practices to digitally enhanced teaching as another setback. This prompted the Uganda government to organise tooling and retooling workshops for teachers in 2017 across the country to equip them with necessary ICT skills (Dubey, 2016:37).

The government also mobilised the NGOs to fund ICT programmes since most of the investment in ICT in schools was implemented by these NGOs while the MoES played a major role in coordinating all the projects (Namae, 2020:7). Although no national figures were given to ascertain the actual impact of the government's initiatives to reduce student-computer ratio in schools, supply of ICT equipment to schools was increased (Ndidde et al., 2009:55).

2.12.3 The Rationale for the Introduction of ICTs in Kenya

The introduction of ICTs in developing countries has drawn considerable attention in recent years due to its programme one laptop per child programme (Kozma & Volta, 2014:885). The rapid development of technologies in education attracted the attention of the authorities in Kenya (Makoba, 2016:3). This prompted the Kenyan government to develop a national ICT policy (Nduati & Bowman, 2005:56). The development of the national policy was vital since it gave guidelines for the implementation of ICTs in the country (Makoba, 2016:18). The efforts of the Kenyan government were complemented by the aid of donor agencies including UNESCO, which helped to fund the policy-making process. Waema (2005:150) and Farrell (2007:75) concurred that fast and haphazard growth of IT and a lack of direction and regulations gave rise to the development of ICT policies in Kenya. Kenya's national ICT policy was adopted in January 2006 after many failed attempts in the years before (Kariuki, 2009:1; Waema, 2005:150). The policy was rooted in the following basic guidelines: an appropriate policy and regulatory framework, human resource development, infrastructure development and stakeholder participation. When it comes to human resource development, it was established that the strengthening and streamlining of ICTs was needed. This was to be achieved through:

a) The promotion of ICTs from primary to tertiary level together with the development of ICT curricula that equips teachers and trainers with the required ICT skills.

b) The setting up of a framework for evaluating and certifying ICT training programmes (Ministry of Information and Communication, 2006).

Furthermore, the policy set down the framework considered to be crucial for development and use in e-learning. As for infrastructure development, the Kenyan national ICT policy aimed to provide affordable infrastructure that would help with the dissemination of knowledge and skills using e-learning platforms and promote content development that would address educational needs of primary, secondary and tertiary institutions. By equipping educational institutions with digital equipment, the government hoped to stimulate ICT integration in education. It was expected that when the institutions received ICT equipment, the issue of access and equity for many learners would be resolved. The policy also aimed at promoting the sharing of e-learning resources between institutions and exploiting other e-learning opportunities that could be offered to the Kenyan education programmes and exported (Makoba, 2016:18).

2.12.3.1 Government investment in ICT initiatives in Kenyan primary and secondary schools

The national ICT policy of the Government of Kenya acknowledges the need for Public-Private Partnership (PPP) in addressing ICT challenges in the country (Albion, Wu, Kist, Orwin, Maxwell & Maiti, 2016: 111). This is confirmed by the level of investment in ICT initiatives that are embedded in their ICT policy. The government established an ICT unit at the MoE's headquarters to make sure that systematic efforts are made to strengthen the adoption of ICT use in the education sector in general (Albion et al., 2016:112). To ensure success in the implementation of all ICT initiatives embedded in the ICT policy, the Government of Kenya through the Ministry of Education, Science and Technology (MoEST) adopted coordination, oversight and mobilisation roles. The aim was to bring together all the key stakeholders in ICT education in the country (Farrell, 2007:21).

The Government of Kenya entrusted the implementation of ICT to the Trust Fund to ensure success. The Trust Fund is a registered consortium under the NGOs in Kenya, and it pulls together several other partners from the private, public and civil society sectors (Prestridge & Tondeur, 2015:191). The Permanent Secretary of the Ministry of Education chairs the Trust. The main objective of the Trust was to help with the mobilisation of funds to make sure that all secondary schools in a period of four to five years have computer laboratories. One of the key partners Microsoft Partners in Learning confirmed that a 5-day training course was successfully given to more than 500 secondary school teachers in Kenya (Hennessey et al., 2010:21). It also helped in organising and directing contributions from the Trust worth over \$80 000 and the contributions included among other things, donated computers (Communication Commission Kenya, 2005).

On the other hand, a sizeable number of initiatives managed to deliver ICT infrastructure to mainly secondary schools. The NGOs, parents and development agencies from the private sector in the country supported the initiatives (Farrell, 2007:21). On the other hand, Microsoft Partners in Learning Program supported some of the notable initiatives like the EMIS, Computer for Schools-Kenya and the NEPAD e-school initiative. To understand the impact of some of these initiatives, a study of 56 purposefully selected Kenyan schools that had computers was conducted (Makoba, 2016:18). The study revealed that computers were only received by 59% of the schools through government and NGO donations, while about 18% were acquired from the school funds or the CFSK initiative (Farrel, 2007:21) The Parent-Teacher Association contributed 16%, while 7% was from individual students (Oloo, 2009:6).

The quarterly report of the period April-June 2008 on the Kenya Education Sector Support Programme highlighted the establishment of the EMIS without mentioning that it was not web-based (MoE, 2008). The objective of the EMIS was to harmonise and integrate the information systems to support timely collection, processing, dissemination and the use of this data to identify relevant intervention strategies and the achievement of quality education in schools (MoEST, 2005:75). However, this led to limitations in access and updating, which caused data from the districts not to be migrated to the national platform. As for the ICT infrastructure and software development, the Kenya Education Sector Support Programme report, pointed out that Microsoft software licences were acquired for schools. However, not enough funds were available to renew the licences (MoE, 2008). A survey by Oloo (2009:7) revealed that on average, there were 21 computers per school in the 56 schools that were purposefully selected giving an average of one computer per 21 students. About 20 of the schools were still using old model computers received from donations more than five years earlier which were already obsolete. About 59% of the schools surveyed did not have internet connections. The statistics indicated that access to ICT facilities in schools in Kenya was very low and there was not enough ICT equipment for education purposes.

2.12.4 The Rationale for the Introduction of ICTs in Rwanda

Rwanda is a landlocked country and is considered one of the poorest nations of the world with a painful history of conflict. The country agreed to make ICTs central to its Vision 2020 (Hennessey et al., 2010:25). This became one of the pillars of the country's National Information and Communications Infrastructure Policy and Plan, which was adopted in 2000 (Haiyana, Hitimana, Munyengabe & Yiyi, 2017:7194). The expectations were that by 2020 the country would have achieved middle-income status through the modernisation its key sectors using ICTs (Muhametjanova & Çagiltay, 2012:500). This vision which started in 1998 through a national consultative process was the reason for Rwanda to formulate an ICT policy (Were et al., 2007:29) which was adopted in 2000. This was much earlier than any other East African country. However, the policy was implemented in planned phases for five years known as the National Information and Communications Infrastructure (NICI) (Haiyana et al., 2017:7194).

The first phase started in 2001 and was concluded in year 2005, while Phase 2 started in 2002 and stretched to 2010 (UNECA, 2006:22). The plans and phases were based on Rwanda's 2020 Vision. The focus was on the following:

a) The transformation of Rwanda into an ICT-literate nation.

b) The transformation of the educational system using ICTs with the objective of improving accessibility, quality and relevance to the developmental needs of Rwanda.

c) The improvement of the human resources development capacity of Rwanda in line with the demands of the economy (UNECA, 2006:38).

All the plans and activities for the integration of ICT in education in Rwanda are clearly elaborated in the NICI-2010 plan. The NICI-2010 plan has seven ICT policy actions related to education that are embedded in it. Three of the policies have a direct bearing on primary and secondary education. One focuses on the use of ICTs in formal education, two focus on the formal education in ICT improvement and three were aimed at helping educational institutions improve their business processes. The NICI-2010 plan also outlines planned actions and timelines that could assist towards the achievement of all the intended goals. Accordingly, Rwanda has recorded a dramatic rise in ICT use in schools (UNECA, 2006:280). Farrell (2007) concurred that Rwanda's ICT growth rate saw more than half of primary schools and secondary schools being equipped with ICT hardware in a space of six years compared to the year 2000 where only one school in the whole country had a computer (Kayisire & Wei, 2016:630).

2.12.4.1 Government investment in ICT initiatives primary and secondary schools in Rwanda

The Government of Rwanda's investment in ICT was very high; hence, it chose to prioritise this sector. The Ministry of Education together with its development partners implemented several initiatives that were in line with the NICI plans mentioned above. Some of the activities indicated in the NICI-2010 plan are:

i. The training of primary and secondary teachers on teaching with the use of ICT.

ii. The Rwanda national library network.

iii. Implementation of the Education Management Information systems (EMIS).

iv. The scholarship management programme.

v. Development of new e-learning content.

vi. Conversion of existing Computer-Based Training and e-Learning Content to Kinyarwanda (NICI-2010).

vii. Carrying out a survey of educational software for potential use in formal and informal ICT training programmes (UNECA, 2006:13).

Other plans that were relevant to the implementation of ICTs in primary and secondary schools were laid out in the NICI-2010 plan. These plans include the following among others:

i. A programme to help with the acquisition of computer equipment by educational institutions,

ii. The National SchoolNet Project.

iii. National public awareness programme targeted at promoting Rwanda's 2020 Vision of transforming Rwanda into a middle-income class.

iv. An initiative to develop a national computer curriculum for primary and secondary schools and coordinate computer education in Rwandan schools.

v. A programme to train a critical mass of computer literacy teachers.

vi. Special ICT in education programmes and initiatives (Igbo & Imo, 2017:77).

As discussed earlier, Rwanda enjoys a well laid-out and detailed plan for the integration of ICTs in education. Its coordinated implementation programme has led to a significant increase in the availability of ICT in primary and secondary schools. The information also shows that there is tremendous direct government investment in ICTs in the education sector to complement the efforts of donor agencies. If Rwanda's accelerated rollout of ICTs in schools continues unabated, it would significantly resolve the country problems related to ICT access in its schools. However, there is a need to monitor the pedagogical impact of these ICTs in the education sector (Haiyana et al., 2017: 7196).

2.12.5 The rationale for the introduction of ICTs in Burundi

The crisis in Burundi in 1993 had a devastating effect on education and exacerbated the underlying problems that existed prior to the 2004 ICT policy update which was then adopted by the Burundi Government in 2007 (Hare, 2007:4). The 2004 ICT policy was introduced to promote ICT connection in the rural areas of the country (Novatech, 2008:2). With the adoption of the new ICT policy, the country was expected to achieve its six strategic objectives which were: enhancement of a legal and regulatory environment; capacity building promotion of a base infrastructure; promotion and encouragement of private investment; promotion of good governance; and promotion of the development of content and applications (Hare, 2007:6). Despite recognising that ICTs are enablers of the education system, the country still does not have a specific policy for ICT use in the education sector. One can only conclude that the government's ICT initiatives are not core to its development plans (Hare, 2007:11; Novatech, 2008:2).

2.12.5.1 Government investment in ICT initiatives primary and secondary schools in Burundi

In Burundi, there is no documentation that indicates how ICTs were used in the national public-school systems. Even though several privately-owned secondary schools taught basic computer lessons, most schools use do not use computers for learning and teaching but rather for administrative purposes (Hare, 2007:5). Burundi had an estimated 14 000 internet users in 2007 and over 80 000 mobile phones in a population of around 7 million people (World Bank, 2007:5). In 2009, internet users increased remarkably to 65 000, which meant that in a space of two years there was an increase of 51 000 internet users (World Bank, 2007:5). In summary, it is very difficult to come up with accurate statistics regarding government investment in ICTs in Burundi due to a lack of data in published documents. Even the official government website had no information in this regard. Therefore, it can be concluded that the country is still struggling with the post-war re-settlement efforts and infrastructure like classrooms and teacher accommodation (World Bank, 2007:5).

A close look at the information from the five East African countries reveals that ICT policies were developed at the turn of the millennium in 2000. This period saw many countries formulating strategies to achieve Millennium Development Goals (MDGs). Secondly, even though the reasons for formulating policies varied from one country to another, they were all intended to alleviate poverty by training skilled manpower and providing education in line with the Education for All (EFA) agenda. Thirdly, the presence of donor agencies was strong and enabled various governments in their pursuits to formulate their ICT policies. Lastly, according to some reviews, regardless of how comprehensive and articulate the formulation of these policies was, the implementation was not impressive. However, it is not enough to look at ICT policies in Africa; they should also be looked at from the European perspective to compare them with the African context. Accordingly, the next section gives an overview of the Scottish Education ICT policy.

2.13 AN OVERVIEW OF THE SCOTTISH EDUCATION ICT POLICY

The adoption of ICTs in educational institutions is gathering momentum globally as there is a need to transform the culture of teaching and learning, prepare learners for knowledge society, accelerate development efforts and promoting equity while bridging the digital divide (Akbulut, Odabasi & Kuzu, 2011:175; Dae, Yang & Hyeonjin, 2010:7; The Highland Council, 2015:2). This is also evident in the Scottish education system. The Scottish government introduced ICTs into their education system to develop ICT skills that would support learners in their learning, social life and prepare them for work (The Highland Council, 2015:7). The Scottish government focused on five pivotal areas in all its council schools, namely, appropriate technologies, good pedagogical practice, infrastructure, professional development and school leadership. The five areas were key to the Scottish education system because they were supposed to pave the way for a successful ICT integration in the education system (The Highland Council, 2015:7-8). The development of ICT policies in the Scottish education system is very important since they help to provide schools with clear guidance. The policies also gave appropriate measures on how risks are mitigated (Edinburgh Council, 2015:8).

Concerning infrastructure, secondary school learners in secondary schools preferred ICT model schools because they provided learners with individual devices such as iPads and tablets that they could use for more creative learning at school and at home (Edinburgh Council, 2015:8). In primary schools, a different approach was implemented in the sense that a sizeable number of devices were provided in each class for small groups of learners to share (Collie, Lewis & Mero, 2011:9; Edinburgh Council, 2015:2). The grouping of learners promoted cooperative learning that is regarded as an important skill in the twenty-first century since it provides an opportunity to learners with different learning potentials to work together.

Regarding the provision of programmes by the Highland Council, it is the responsibility of providers to develop enabling infrastructure and a technology-rich environment in different schools. They must also provide mobile devices such as iPads and tablets to pupils in model schools (The Highland Council, 2015:7). The ICT policy also stipulates that the internet must be available to all schools and that all teachers and learners should be provided with personalised access to the internet, virtual learning and a variety of tools. This will enable collaboration, cooperation and communication across the network (The Highland Council, 2015:7). All schools were encouraged to pursue the curriculum for excellence as the Aruba Wireless network was available to provide internet access for both teachers and learners. (The Highland Council, 2015:7). The Scottish education department also regards teachers as key determinants of effective use of ICTs in teaching and learning. For this reason, it established the Computer Application Technology (CAT) coach model to boost teachers' confidence and competence in integrating technology into their teaching activities (Wilson & McKinney, 2012:67).

School principals in Scotland are considered to be ICT leaders and have a big task of developing plans with ICT teams to promote school vision. They achieve this by using an online head-teacher toolkit to access all the necessary information that they can use to model what their teachers and learners may need. As school managers, principals are expected to take a leading role in teacher and learner support. Some responsibilities of principals include arranging ICT budgeting issues, purchasing software, choosing hardware, arranging equipment in schools, employing ICT coordinators and developing school-based ICT policies (The Highland Council, 2015:7). Principals also ensure a positive implementation of ICTs across the curriculum (The Highland Council, 2015:7).

The comparison of ICT policies of some African countries and Scotland was intended to provide insight into how other countries implemented them in comparison with South Africa. The next section looks at some changes in the South African education system, and how they have influenced the development and implementation of ICT. To analyse the ICT situation in South Africa, the following topics were discussed: education and policy changes, the introduction of ICTs in the education system, the status of ICTs in schools and the limitations of successful integration of ICTs in schools.

2.14 CHAPTER SUMMARY

This chapter focused on different learning theories that endorse the use of ICTs in teaching and learning in the twenty-first century. It also explored the theoretical framework that underpins this study. It also highlighted the principles, significance and criticisms levelled against connectivism, behaviourism and constructivism in teaching and learning using ICTs. Through these discussions, it was evident that the evolution of the learning theories was important since each learning theory made sure that the educational goals that are envisaged in the national education policies are realised. For example, the connectivism learning theory was deemed the most appropriate learning theory for the integration of ICTs in the education system compared to behaviourism and constructivism.

The discussions also indicated the need for teachers to employ and embrace ICTs in teaching and learning. The chapter also looked at the relevance of the theoretical framework and pedagogical practices that should be used by teachers to gain and share knowledge with their peers to improve their teaching strategies and enable learners to gain the skills that are vital in the twenty-first century. This is important in this study that seeks to explore strategies for improving learner and teacher performance through effective use of ICTs in Soweto secondary schools. The chapter highlighted the implementation of ICTs in some African and European countries and the limitations that hindered implementation. It further explored the implementation of ICTs in South Africa, their status in South African schools and the theories that are aligned with the implementation of ICTs education. The next chapter presents information on how ICTs have been introduced in education to enhance teaching and learning in schools.

CHAPTER 3

THE INTRODUCTION OF ICT AND ITS IMPACT ON INSTRUCTION

3.1 INTRODUCTION

The previous chapter provided an overview of the current and anticipated future use of ICTs in teaching and learning in South Africa to shed light on how this was optimised in the classroom. The chapter also discussed the general e-education landscape in South Africa and the conceptual framework that frames the study and reviewed different policies on the use of ICTs. It also reviewed the emergence of ICT policies in East Africa to understand how other African countries handled them. This chapter provides information on how ICTs have been introduced in education to enhance teaching and learning in schools. The chapter also looks at the achievements, impact, benefits and challenges that have been faced in the implementation of ICTs in education in general.

3.2 THE IMPACT OF ICT ON TEACHING AND LEARNING

There is a widespread belief that the introduction of ICTs in teaching and learning plays a very important role of modernising the education system and the learning process (Dlamini, 2018:5). The transformation brought about by ICTs also brings along new skills and competencies for teachers which are essential for the successful implementation of digital learning. However, Dlamini (2018:5) argues that a consensus has not yet been reached in literature on the impact of ICT on teaching and learning. Some authors such as Dube, Nhamo and Magonde (2018:88) maintain that ICTs have revolutionised the learning and teaching of curriculum in many educational institutions including schools. They further argue that most educational institutions have already adapted to the use of ICTs in the learning and teaching process by their classroom environments to be compliant with digital learning. For example, many schools have stopped using blackboards and have replaced them with smart boards or interactive whiteboards that make it easy for teachers to present stimulating lessons for the learners. They also use whiteboards that are suitable for projecting information from the projector. Murithi and Yoo (2021:1) concurred that the use of ICTs in the teaching and learning process assist learners to grasp concepts that would have otherwise been difficult to understand.

Although, ICTs have benefits in the education system, there are other dynamics that are associated with its integration in the classroom that are not always positive (Munje & Jita, 2020:263). Some of the factors that need to be taken into consideration for successful integration of ICTs include among other things teachers' skills, teachers' attitudes and perception of ICTs, availability of ICT skills, infrastructure and connectivity. Rabah (2015:24) referred to all these factors as the context of the school and emphasised that the successful integration of ICT-based education is dependent on the context, setting and environment of the school. Karunaratne, Peiris and Hansson (2018:118) concede that lack of ICT resources can negatively hinder ICT use in the classroom and defeat its intended purpose of making teaching and learning better. In the same vein, Denoon-Stevens and Ramaila (2018:432) postulate that the availability of ICT resources especially in disadvantaged communities, are key to the success of ICT integration in the education system, a thought also shared by Ismail et al. (2020:1537).

Olanyika (2022:1) also argued that the integration of ICTs in the education system helps learners to understand better the topics taught in the classroom and it also makes it easy for learners to access information. However, Hodges, Moore, Lockee, Trust and Bond (2020) criticise the use of ICTs for failing to uphold sound pedagogical principles and best practice. Selwyn (2020:73) concurs that technology cannot be used for quick fixes in education as it will trigger adverse effects on the learners. Furthermore, Schmidt and Williamson (2020:23) maintain that the use of online platforms can be a danger and can have an adverse impact on learners due to limited privacy and possibilities of surveillance. It is argued that the prevalence of undesirable websites poses a real threat as learners tend to spend learning time on websites containing unhealthy content, such as pornographic material as they explore the internet (Hodges et al., 2020). The prevalence of undesirable websites is a major threat to the learning and teaching process since it will force the teachers to spend more time trying to prevent learners from using such websites with content unrelated to the learning process (Schmidt & Williamson, 2020:23). All these challenges bring into question the issue of security. This is access to information security and not physical security. If the security is lacking, the openness of the web may tempt learners to explore unsecured sites which often hinder effective learning in time-constrained formal school systems (Kshetri, 2021). Without teachers' supervision, students might misuse the technology for leisure-time activities and have less time to learn and study (Naik, 2020:1). When learners are not supervised, they might be revealed to online gaming, social medias like Facebook, chat rooms and other communication channels that are perceived to be the drawbacks of ICT use in education. This is possible because learners can easily switch to using them at the expense of learning if they are not properly monitored.

It is also of great concern that learners get access to the use of ICT websites with unsolicited and harmful content; this may cause them to develop anti-social behaviour such as violence, Satanism, promiscuity and the like. This is possible because some learners may easily imitate whatever they watch on these websites. If ICTs are implemented properly in schools, there are several benefits that can be derived for learners and teachers alike. In research conducted in South African secondary schools, it was found that if ICT is implemented properly, it could have major benefits for learners, which included among other things, increased motivation, increased active participation, improved knowledge and skills, increased responsibility and self-esteem and increased collaboration (Mdlongwa, 2012:4). Subsequently it was also established that good ICT implementation has some administrative advantages like enabling schools to access learners' records faster, making record-keeping more orderly, lowering administrative costs like photocopying and providing information or communication within schools much more quickly and efficiently by using emails or PowerPoint presentations in class. Another advantage is that the use of data projectors helps to visually stimulate learners by showing practical real-life situations and learners could learn more and practise more through online applications (Mdlongwa 2012:4). Although the benefits of using ICT in schools are immense, Mikre (2011:13) identified the following major problems associated with the ICT use in education as related to students' learning:

i. "Over-reliance on ICT limits students' critical thinking and analytical skills.

ii. Student often have only a superficial understanding of the information they download.

iii. Computer –based learning has negative physical side-effects such as vision problems.

iv. Students may be easily distracted from their learning and may visit unwanted sites.

v. Students tend to neglect learning resources other than the computer and the internet.

vi. Students tend to focus on superficial presentations and copy from the internet.

vii. Students may have less opportunity to use oral skills and handwriting.

viii. Use of ICT may be difficult for weaker students, because they may have problems with working independently and may need more support from the teacher".

Despite the negative aspects that ICT may bring, some scholars like Isaacs (2007:429) have found growing evidence that the use of ICTs may be the only feasible and economically sound means of expanding access and improving the quality of secondary school education in the short run. Peter (2010:10) reiterates that the economic rationale for ICT in education relates to potential increase of efficiency and effectiveness in educational tasks, which would result in labour-saving costs. He also argues that ICT can improve the quality of education by providing rich, exciting, motivating and new environments for learning (Peter, 2010:10). For Van Ark (2011:6), the focus is on the positive social aspects that are brought by ICTs.

In a study by Balanskat (2007:16), it was established that 79% of teachers believed that using computers in class has a significant impact on learning, while 21% of them believed that it did not. In this respect, Wheeler (2000:7) argues that ICTs have the potential to enable teachers and learners to use video systems to transmit television programmes and information throughout the entire school and even between schools in the same district. In turn, ICTs enable teachers and learners to share resources, and thus minimise costs, while simultaneously improving the quality of teaching and learning, especially in under-resourced schools. ICTs can also enable learners to share learning space. When talking of shared learning spaces, networked computing facilities create a distributed environment where learners can share workspaces, communicate with each other and their teachers in text form, and access a wide variety of resources from internal and external databases via web-based systems through the internet (Di Pietro, Biagi, Da Costa, Karpinski & Mazza, 2020:34). The sharing of learning space could reduce the problems of overcrowding and a lack of teachers which are high in some schools.

Furthermore, ICTs promote collaborative learning and autonomous learning. Autonomous learning enables learners to exercise more choice over how they approach studies, requiring less direction from teachers (Di Pietro et al., 2020:9). Thus, ICTs can significantly enhance educational reforms which enable teachers and learners to move away from the traditional to the more innovative and effective approaches to teaching and learning (DoE, 2003). ICTs also motivate learners, provide variety, compensate for language deficiency, encourage active participation, reinforce learning, increase application possibilities, enhance the applicability of learning content provided for the learning needs of individual learners, and supplement the spoken word (Kruger, 2010:5). Finally, a careful deployment of ICTs brings about both the quantitative (access) and the qualitative (standard) gaps in secondary education because ICTs can be used to make education accessible to more learners (Graham, Stols & Kapp, 2020:759).

3.3 BENEFITS OF INTRODUCING ICTS IN SCHOOLS

Despite some of the challenges that were mentioned earlier in this chapter, introduction of ICTs in schools came with many positives for the learners and institutions of learning like schools (Agbo, 2015:17). The benefits of technology are multi-faceted as they provide opportunities for the development of a wide range of skills like pedagogy, teacher competencies, curriculum and school readiness although introducing ICTs in teaching and learning does not automatically mean that institutions will realise the benefits of these technologies (Aktaruzzman et al., 2011:114). According to Mhlanga and Moloi (2020:18), Kayembe and Nel (2019:80), and Oke and Fernandes (2020:2), many challenges like social exclusion can easily be resolved by using technology. Technology can help close the gap between the rich, the poor and even among different races. In addition, technology can also help resolve access to education especially in institutions of higher learning which usually have limited number of spaces available for students (Mhlanga & Moloi, 2020:18). Technology can also promote opportunities for innovation and creativity (Kayembe & Nel, 2019:79). Introducing ICTs in the education sector also helps build a workforce that has ICT skills and citizens who can manage their lives effectively by using technology (Meyer & Gent, 2016:16). The next paragraphs discuss the benefits that are brought by the introduction of ICTs in schools.

3.3.1 ICTs as an E-learning Tool

It is no secret that many educational institutions are exploring new ways that they can use to reach out to learners. Online and blended learning are some of these new ways (Graham et al., 2020:750). One of the platforms that was adopted is the learning management system (LMS) with the aim of delivering online and blended courses (Sesabo, Mfaume & Msabila 2015:329). LMSs are software platforms. They are designed specifically to assist teachers create online courses with the aim of encouraging interaction and collaboration between teachers and learners (Ollesch, Venohr & Bodemer, 2022:3). The LMSs have been adopted by many institutions. One example of an institution that has adopted an LMS is the University of Education, Winneba in Ghana. The lecturers at the university are also given training on the LMSs. Discussion forums, student self-evaluation, student tracking and grading are some of the tools that are provided by the LMS (Selles, Carril & Sanmamed, 2019:1). The tools make it possible for course materials to be distributed to students via the internet. To manage learning content and monitor if the students are uploading their work, lecturers use Moodle. Moodle is a platform that was designed to give educators, administrators and learners an open, robust, secure and free platform to create and deliver personalised learning environments (Bradley, 2021:68). However, he further argues that to successfully implement LMSs, one does not have to depend solely on training and supporting lectures, but rather by making sure that students are actively using these LMSs.

In Ghana, the research conducted by Adarkwah (2020:1669) after Covid-19 revealed that there were some difficulties experienced by students when using online learning platforms to navigate through course content. The problems the students faced included uploading of assignments and being unable to access course material which was caused by irregular internet access. In addition, it was found that students only accessed lecture notes and coursework on online platforms but did not use the LMSs to create content and interact with other students. Therefore, online platforms were only used as repository of material and information. This could have been caused by the lack of knowledge on LMSs by some of the students (Adarkwah, 2020:1674). The findings by Adarkwah in Ghana cemented the findings of an earlier study by Nkonki and Ntlabathi (2016:257) at the University of Fort Hare, South Africa which had similar outcomes. Their study focused on forms and functions of teaching and learning innovations and the use of the blackboard among lecturers. In fact, the study revealed how the lecturers used the blackboard as a substitute for the traditional way of doing things. According to the findings of the study, lecturers uploaded materials to the LMS so that students could access it instead of printing it and then giving it to the students. This is a great risk because uploading materials online is no guarantee that students will interact with the material (Nkonki & Ntlabathi, 2016:257).

UNISA is a good example of an institution using an LMS. UNISA is an open distance learning institution with the highest number of students on the continent (Mkhize, Mtsweni & Buthelezi, 2016:295). The university uses an LMS called MyUnisa. The system is used for communication and for teaching and learning purpose. This is done to close the gap in distance of lecturers and students (Mkhize et al., 2016:295). A study conducted at the University found that the students were impacted by the compatibility and relative advantage of MyUnisa (Mkhize et al., 2016:295).

3.3.2 ICTs as Resources

The negative factors that arise in our educational institutions such as a shortage of instructional materials and higher learner-teacher ratios can be countered by using ICTs (Aljaraideh & Batainek, 2019:99). Previous studies have revealed that effective teaching and learning does not take place in poorly resourced and overcrowded classrooms. For example, Macupe and Hawker (2012) explain how effective teaching and learning could not take place in Sakhikamva High School in East London with 90 Grade 9 learners in a single classroom. Therefore, in such a context, the use of ICTs would come in handy since the teacher-learner ratio is too high (Hart & Laher, 2015:1). The technology can, therefore, be used to deliver the curriculum and learners can access educational programmes including websites on their tablets. If, for example, it is a language lesson, ICTs can be used to assist learners improve their speaking skills, listening skills, grammar and pronunciation (Balagiu, Patesan & Zechia, 2018:142; Mafurag & Moremi 2017:143). A survey carried out using students around the world also revealed that most students accessed academic information, course material and course schedules through their tablets or smartphones (Goad, 2012:31). One could conclude that the reason why most students use these devices to access educational information, course materials and course schedules is that the devices are portable and easy to use. Thus, learners find it easy to access information using these devices. The devices also become very handy for learners if they want to access diverse communication options such as videos and voice-calling messages, blogs and emails. All this makes it convenient for students to exchange learning resources and simultaneously collaborate on schoolwork.

In addition, Chisango (2019:106) argues that portable devices have games that can measure learners' progress and allow teachers to personalise learning for individual learners. Arends (2021:89) concurs that when learners use mobile devices and have access to the internet they are revealed to rich information and abundant of ideas. Van Deursen, Allouch and Ruijter 2016:971) further postulate that for learners living in the digital world, the use of textbooks is outdated. Therefore, it is paramount for learners to be revealed to ICT infrastructure such as smartphones and tablets. Paton-Ash and Wilmot (2015:2) provide insight into Soweto schools where it was found that most low/non-fee-paying schools had books that were irrelevant to the curriculum in their libraries. Some of the books were also outdated. Therefore, the adoption of ICTs in school can ensure that every learning area is fully equipped with suitable learning material. Learners will be able to access the internet for information and do away with relying heavily on hard copies (van Deursen et al., 2016:971). Consequently, ICTs can also be helpful, especially to unqualified teachers. Fomunyam (2019:30) concurs that the use of ICTs in both primary and secondary school education systems in Africa improves the quality of teaching and learning in schools, while bringing growth and development to economies simultaneously. The use of ICTs also allows teachers in Africa to collaborate with other teachers online globally, and access training programmes and courses that will help them to be impactful in their teaching (Fomunyam, 2019: 33). This means that with ICTs at their disposal, teachers can upgrade their qualifications and knowledge through distance learning at universities such as UNISA.

3.3.3 ICTs as Assessment Tools

Teachers can use technologies to carry out both formative and summative e-assessment. However, Setiyadi, Isnaeni and Ellianawati (2021:498) argue that assessment using technologies can only be used by teachers with adequate ICT skills to present and monitor learners' work. Ningrum, Slameto and Widanti (2018) concur that when ICT-related assessments by teachers are only knowledge-focused, learners become less responsible, less able to work together, and collaboration between teachers and learners is ruined. Therefore, ICT-based assessment should be authentic and comprehensive in measuring learners' achievements (Hassah, Edwita & Januar, 2020). Researchers such as Effendi, Bustanur and Mailani (2019:81) firmly believe that if ICT-based assessment is done properly, it can increase learners' ICT literacy, a skill that is important in twenty-first century cognitive competence. On the other hand, Chigona, Chigona, Kayongo and Kausa (2010:21) view technology-based assessment as having two visions. The first vision is a mastery learning strategy which provides teachers with information on which content learners have mastered well and how to further point out areas that need additional support. The second vision according to Chigona et al. (2010:21) has to do with accountability systems. These systems benchmark students as they progress through a curriculum that is standards-based in order to give a picture of students' thinking process. Both approaches, however, help the teacher establish an overall idea of where they can start to give guidance to the learners. Simultaneously, if assessments are done by means of ICT, there is an increase in reliability of scores. Furthermore, when assessments are done by means of ICT, there is very little room for markers to manipulate the marks.

3.4 LIMITATIONS TO THE SUCCESSFUL INTEGRATION OF ICTS IN SCHOOLS

It is not an easy task to integrate ICTs into teaching and learning as there are some difficulties to be encountered in the process (Graham, Stols & Kapp, 2020:750). The same was echoed by Mfaume and Msabila (2015:329) who state that even though there are several advantages that come with the adoption of ICTs in teaching and learning, there are challenges as well. These challenges are categorised as technological, contextual, course-related and personal characteristics. Graham et al. (2020:752) also list the following limitations to successful ICT integration: a lack of teacher confidence; a lack of effective training; a lack of teacher competence; a lack of technical support; resistance to change; negative attitudes; and a lack of infrastructure. Some of these limitations or challenges are briefly explained below.

3.4.1 Teachers' Attitude Toward ICT

Teachers' attitudes towards the use of ICTs play a vital role in the teaching and learning process (Shuro, 2020:21). In his study on primary school teachers' attitudes towards the use of ICTs in South Africa, Nyathi (2022:70) noted that not all teachers have passionately integrated ICTs in their teaching as some of them have rejected it outright. They resist ICTs in the classrooms because they fear losing influence over the values and directions of classroom activity, lack of training, lack of time and inadequate resources (Nyathi, 2022:70). A recent study by Rana and Rana (2020:36) also established that the reason why ICTs are not used by teachers in many schools emanates from their lack of necessary knowledge, bad attitudes and a lack of skills to adapt to changes brought by technology in education. Akinami (2021) and Gyamfi (2017:52) found the same factors to be the challenges confronting schools. They maintain that teachers whose attitudes are negative towards the use of computers are less likely to adopt the use of ICTs for teaching. Similar findings were obtained by Young (2016:165) in Ireland when it established that teachers' attitudes towards the use of tablets prevented the use of ICTs in the classroom.

3.4.2 Teacher Training in ICT

The use of ICT in teaching, learning and managing educational institutions, as any other innovations lead to the acquisition of a new set of skills, attitudes and pedagogical approaches that require continuous training programmes in order to build sufficient capacity among teachers, developers, and administrators (Nyathi, 2020:70). It is firmly believed that merely introducing ICTs in schools does not, by itself, improve the quality of education, neither does it improve teacher and learner performance. It is critical to ensure that there is sufficient awareness on the pedagogical and technical expertise of the teacher in order to get positive results. Thus, the motivation and confidence to integrate ICT in teaching and learning could only come from having access to ICT equipment and possessing the required ICT skills (Mhahla & Moloi, 2022:18). A study conducted in Bushbuckridge, South Africa revealed that some teachers, especially in rural areas are not getting professional development at all (Ngobe, 2023:61). A similar study carried out in Gauteng primary schools revealed that most teachers lacked the expertise in the use of ICTs (Nyathi, 2022:59). The study recommended that the government must emphasise teacher development to effectively implement policy and curricula related to ICTs to enhance teaching and learning, and eventually raise educational standards. In many African countries, however, the major drawback is a lack of qualified teachers. This problem is further exacerbated by growing poverty, a lack of funding for teachers' salaries, and the exponential rise in student population that is experienced in these countries (Dube, Nhamo & Magonde, 2018:89).

Effective introduction of technology in schools depends upon the availability and accessibility of ICT resources. For this reason, schools should be equipped with computers, internet access and other sophisticated equipment like interactive whiteboards rather than mere introduction of hardware in the classroom for e-learning to be effective (Mhlana & Moloi, 2022:7). Furthermore, teachers must be proficient in using ICT tools in order to embrace change and become effective in their teaching (Hadzovic, Becirspahic & Omeragic, 2022:434). There is a need, therefore, to prioritise teacher training for effective ICT integration in the classroom (Hasin & Nasir, 2021: 59). However, it has been observed that countries are now putting more focus on the formulation and implementation of national ICT policies. Nevertheless, there are still some gaps when it comes to the implementation. A major obstacle that has been seen is that in most developing countries, especially in Sub-Saharan Africa (SSA) is the national policies. The school curricula tend to treat ICT as a discrete subject in the form of Computer Science or IT for assessment purposes by the national examination boards.

There is a universal emphasis to teach skills on software use and information gathering rather than integrating ICT into subject learning since research has shown it to be more effective for students (Hennessey et al., 2010:40). However, ICTs can be impactful in schools, only if the lack of contextually appropriate course content for both teachers and learners is addressed. Coupled with addressing the issues of contextually appropriate content for teachers and learners, there is also a need to address infrastructure issues. Although there is a great deal of progress and optimism towards ensuring that more learners benefit from access to ICTs, there is still a problem of a lack of necessary technological infrastructures in many African countries. Furthermore, many teachers still work in deplorable conditions that are not conducive to supporting ICT use (Mhlana & Moloi, 2022:7). Exploring both teachers' skills and experiences in the use of technology, their personal beliefs and perceptions about ICT is also vital. Chigona (2015:240) went further to suggest the importance of including technologies into teacher training courses of prospective teachers to assist them adopt ICTs in the classroom.

Many studies have explored why teachers choose ICT. The studies include case studies of ICT classroom use in a particular setting or longitudinal studies. These studies have shown that the use of ICTs in teaching and learning produced positive results. Tella, Tella, Toyobo, Adika and Adeyinka (2007:7) examined how teachers' use of ICTs in Nigerian secondary schools contributed to teaching and learning. The study revealed that ICTs were perceived to be very useful and that they made teaching and learning easier for most teachers. Recommendations were also made to support professional development policies that are in support of ICT-related teaching models. This was meant to encourage both students and teachers to play an active role in teaching activities. This implied that teachers will be inclined to use technology if they perceive it to be useful. Shuro (2020:45) proposes that ICTs should be linked to specific needs of learners, instead of using a 'one-size-fits-all' approach. However, educationists are faced with the challenge of how to harness the potential that ICTs have, and how they complement the role of the teacher in the teaching and learning process.

In an effort to consolidate the initiatives of the South African government to train teachers on how to use ICTs, Vodacom established mobile education programmes in nine centres in each province (Ayemoba, 2013:158). Through this initiative, Vodacom wanted to collaborate with the DBE to help boost teacher training across all the nine provinces of South Africa (Ayemoba, 2013:158). The intention of the programme was to train 1 400 teachers annually in the use of ICT to support teaching and learning with a particular focus on mathematics and science subjects. Furthermore, an additional number of teachers from the rural areas of South Africa continue to benefit from the "Train-the-trainer" project which was initiated by the Internet Service Providers' Association (ISPA) in 2001 (Ayemoba, 2013:159). This initiative has already provided ICT skills training to more than 2 000 teachers across South Africa since its inception in 2001 (Ayemoba, 2013:158). The programme targeted schools that were under-resourced and in the rural areas. It was set up to deliver beginner and intermediate level courses (ISPA, 2011:11). However, there was a concern that the initiative focused on beginner and intermediate computer skills for teachers and did not actually equip them with all the necessary skills to benefit fully from ICT use (ISPA, 2011:11). This is important because teachers need to stay abreast of the ongoing changes in the technology sector and the new teaching and learning methods.

3.4.3 ICT Skills for Teachers in the Twenty-First Century

For many school leaders, teachers' lack of ICT-related knowledge is perceived as a major concern that hinders the realisation of ICT goals. Teachers may also need some skills to integrate ICT in new learner-centred learning approaches (Shambare, Simuja & Olayinka 2022:11). For Bialobrzeska and Cohen (2005:111), computer skills for teachers should include evaluation of material found on websites. However, to identify which of these competences are relevant for individual teachers, is not a simple task and depends on the circumstances of each teacher's school and each their teaching style. Therefore, the notion that one-size-fits-all would not work (Shambare et al., 2022:11).

UNESCO (2016) revealed that ICT competency standards for teachers go further to describe three approaches: technological literacy, knowledge deepening and knowledge creation. Therefore, it is not enough for a teacher to be competent in only one or two of the approaches. Rather it is fundamental for the teacher to have competencies in all the three approaches since they complement one another. The three approaches also have different implications for changes in the components of the education system, which include teacher practice and professional development, pedagogy, curriculum, school organisation and administration and curriculum assessment (Ngobe, 2023:76). Therefore, ICT plays an important complementary role in each of these approaches. Nevertheless, introducing new technologies requires new teacher roles, new pedagogies and new strands to teacher education.

Successful integration of ICTs into the classroom depends largely on the ability of teachers to structure their learning environments in non-traditional ways and to merge technology with new pedagogies (Umugiraneza, Bansilal & North, 2018:342). This would require a very different set of classroom-management skills and innovative ways that would encourage and enhance technology literacy in both teachers and learners, knowledge deepening and knowledge creation. This is important because the twenty-first century requires teachers to possess skills that can be used to construct new knowledge, engage teachers in lifelong learning, improve their communication, be creative, be innovative and become critical thinkers. The main emphasis is on teacher development with the focus on developing teachers' sophisticated professional skills with the pervasive use of technology (Aktaruzzaman et al., 2011:114).

3.4.4 Work Environment

School management plays a crucial role in making sure that ICTs are adopted and used effectively in schools (Arends, 2021: 8). Knights, Grand and Young (2020:6) and Lim, Ra, Chin and Wang (2020:2447) collectively agree that the leadership of individual schools also plays an equally important role in shaping responses to ICTs innovation. Therefore, it is the responsibility of school management to make sure that the work environment motivates teachers to use ICTs in the teaching and learning process rather than demotivating them. Research has established that schools that do not embrace ICTs are probably the schools with principals that do not encourage teachers to take up ICT-related courses (Albugami & Ahmed, 2015:41). Consequently, where teachers feel coerced to use ICTs, they usually resist using ICTs in the classroom (Albugami & Ahmed, 2015:41). In agreement with Albugami and Ahmed (2015:41), the DBE (2016) argues that the reason why ICT projects often fail is because some principals are less informed when it comes to the advantages of using ICTs in the teaching and learning process. This was also affirmed by Ogunniyi (2016:151) in the Western Cape. Teachers who were interviewed stated that their principals refused to release money for the renewal of software licences. Without the software licences, computers could not be used for teaching and learning in the classroom. Thus, school principals have the responsibility to create a conducive environment for the adoption of ICTs and simultaneously provide support in managing the integration of ICTs in schools. Research has revealed that schools with principals that are supportive of the use of ICTs in the classroom are most likely to successfully integrate ICTs in their schools compared to those who do not (Manaseh, 2016:30).

3.4.5 Lack of Proper ICT Infrastructure

One of the biggest challenges that schools face when it comes to the adoption of ICTs is inadequate ICT resources like computers in schools (Chisango & Marongwe, 2021:149). The cause of this is that some schools are financially challenged making it difficult for them to afford a computer for each learner in the school (Njoronge, Ngugi & Kinzi, 2017:73). Although governments try to fund ICT projects in schools, the funding is usually insufficient. For this reason, schools with constrained budgets would not afford the computers. Therefore, when there is a shortage of computers in the school, Ngobe (2021:58) argues that only a few learners would be able to use the computers at a particular time if there are fewer computers than the number of learners in each class. This means that only learners with computers will be able access learning material since the learning materials are loaded on the tablets. Albugami and

Ahmed (2015:41) concurred with Chigona et al. when they reiterated that an increase in the number of learners in schools with fewer computers available is a major stumbling block in the implementation of the use of ICTs in schools. This was also affirmed in the study of schools sampled in the Khanya project in Cape Town. The study revealed that there were approximately 25 computers in a class of an average of 40-60 learners. This high learner computer ratio was a major challenge for teachers when they wanted to organise computer laboratory sessions (Davids, 2009:13). Therefore, inadequate ICT infrastructure in schools causes learners to share computers. This leads to some learners not acquiring ICT skills since they are mere spectators.

Furthermore, few computers means that not all teachers are able to integrate ICTs in the teaching and learning process and this will cause the digital divide to continue deepening rather than it being closed (Ngobe, 2021:58). Similar challenges of lack of ICT infrastructure and resources also surfaced in research by du Plessis and Webb (2012) in the Missionvale Township of Port Elizabeth. The research revealed that were inadequate ICT infrastructure and resources in the schools studied. There was a large outcry by teachers for more computers, internet connectivity and support from the DBE. Teachers also indicated that teacher participation and consultation regarding ICT implementation at schools was inadequate. Therefore, teachers felt excluded in ICT-related issues in schools (du Plessis & Webb, 2012:46). However, Marcovitz (2015:3) argues that it is not only about purchasing computers in schools that is important but that there is a need for conditions at schools to be conducive for adoption of ICTs. The study conducted in a school in Cofimvaba in the Eastern Cape Province confirmed the above when data revealed that the successful adoption of ICTs can only be successful provided the conditions on the ground are conducive for ICT integration (Ngobe, 2023:60). This school only had a few teachers and learners from different grades and were all accommodated in one classroom. It also had electricity problems. Therefore, this school did not have a conducive environment for ICT adoption. Obviously, without a reliable supply of electricity to run computer laboratories, it would be very difficult for the school in question to adopt ICT for teaching and learning purposes.

Despite the efforts of the DBE and other stakeholders to equip the South African teachers with the much-needed ICT skills, poor infrastructure remains a major obstacle in many schools (Arends, 2023:66). In the USA, a survey by the National Centre for Education Statistics (NCES) in 2000 using the Fast Response Survey System (FRSS) revealed that 99% of full-time regular public-school teachers had access to computers or the internet somewhere in their schools (Makewa, Maremo, Role & Role, 2013:54). However, this is still a dream in South

Africa even though it has significantly increased the number of computers in schools in recent years. South Africa has also come up with a teacher laptop initiative to increase teachers' access to computers (Arends, 2023:79).

The ELRC managed this initiative with the aim of improving ICT in teaching and learning, to ensure that more than 350 000 public-school teachers owned and used a laptop. The idea was to provide teachers with a monthly allowance which would cover the purchase costs as well as the costs of connectivity (Kalu-Quvane, 2020:1). The initiative was launched by the then Minister of Education, Naledi Pandor in 2009 (Kargiban & Siraj, 2009:147). The Teacher Laptop Initiative (TLI) was supposed to have completed the distribution of laptops to qualifying teachers by the end of 2011 (Tubbs, 2013:1). Sadly, this initiative flopped due to funding problems and the fact that only about 174 000 of about 380 000 teachers who were permanently employed nationally were either blacklisted or not creditworthy (Maluleka, 2011:1). To date, this objective has still not been achieved. However, even if it was to be completed, there was no guarantee that schools especially those in the rural areas and townships would benefit from this initiative due to a lack of the internet, exorbitant internet costs for schools or simply that teachers lacked the necessary ICT skills.

Due to the prohibitive internet costs in South Africa, of about 6 000 estimated schools that had access to PCs, an estimated 2 500 only had internet access (Farrell & Isaacs, 2009:9). Another concern was that the South African government was slow to implement the e-rate policy. The e-rate policy, which started in the USA, is a nationally agreed-upon discount rate of internet costs for schools. In most cases, this rate is included in the relevant telecoms legislation at a national level, and therefore, becomes the responsibility of the regulator (Espitia, Cruz, and Kwinta, 2013:1). If implemented, the e-rate would allow for 50% discount on calls to access the internet as well as internet access charges (Espitia, Cruz, and Kwinta, 2013:1).

3.4.6 Internet Connectivity

One of the major concerns when it comes to the use of ICTs in South African schools is internet connectivity. However, this is not a problem in South Africa only. Many other countries are also experiencing the similar problem. For example, Özdemir (2017:505) revealed that teachers who work in public schools in Bartin City in Turkey complained of the lack of internet connectivity in their respective schools. For this reason, they could not use ICTs for teaching and learning in their schools. Back in South Africa, research was also carried out in six schools in Mafikeng to establish the nature of internet connectivity in schools. From the six schools surveyed, four of the schools had no internet connection at all (Assan & Thomas, 2012:4). The findings from these schools in Mafikeng, South Africa concur with the results found in Turkish public schools. The findings are in line with those of Almazova, Krylova, Rubtsova and Odinokaya (2020:368) who established that there is inadequate access time for both teachers and learners in the developing parts of the world. It was further argued that if learners have no internet connection and do not have internet search skills, such learners are isolated from the information society.

3.4.7 Erratic Electricity Provision

The successful implementation of ICTs is not only about the provision of computers in schools, training of both teachers and learners to improve their ICT skills and the provision of ICT infrastructure. There are other extrinsic challenges such as erratic electricity supply that can adversely hinder the adoption of ICTs in schools (Jayson et al., 2014:63). The use of technologies in the teaching and learning process involve using computers and overhead projectors which need a stable supply of electricity for them to operate effectively. Therefore, if schools do not have reliable supply of electricity, teachers will abandon the use of ICTs in their schools (Ngobe, 2023:59).

3.4.8 Theft of ICTs and Infrastructure Vandalism

Theft can also hamper successful implementation of ICTs for teaching and learning in schools (Ford, Botha & Meraka, 2015:50). Research done at Sibaya High school in Rustenburg in North West Province in South Africa revealed that projectors and telephone cables were stolen. This led the school to lose internet connectivity and it had to rely on a satellite link to access the internet (Blignaut, 2010:1552). For Blignaut (2010:1552), the theft was contributed to the fact that Sibiya High School is situated in a poverty-stricken community where theft is high. Something similar was also reported at Menzi Primary School in Gauteng Province. It was also reported that 185 tablets, eight teachers' laptops, three desktop computers were some of the ICTs that were stolen from the school (Ngqakamba, 2019:1). Sadly, this happened barely a week after the Gauteng MEC of Education had commissioned ICT at the school. Ngobe (2021:58) concurs that one of the setbacks in the implementation of ICTs in schools is a high rate of vandalism and theft.

3.4.9 Lacking Technical Support

Schools should have school-based technical support to assist teachers when they need ICT help. Research on the use of ICTs in South Africa established that teachers are faced with the challenge of dealing with technological tools in the classroom due to a lack of technological support (Mhlanga & Moloi, 2020:6). The study recommended that schools should have a technical support person to assist them as soon as technical issues arise. It was further argued by Hadzovic et al. (2022:434) that the lack of school-based technical support for teachers led to many teachers abandoning the use of ICTs at their respective schools.

Similar results were produced in research conducted on the public schools e-learning project in the Western Cape. Results from the ICT survey indicated that only 8.89% of the selected 45 teachers who took part in the study admitted to receiving technical support and ICT updates frequently (Ogunniyi, 2016:151). Another study conducted in Québec in Canada by Rabah (2015:24) which investigated challenges faced by teachers and educational consultants in the integration of ICTs, produced similar results to those from revealed by Ogunniyi (2016:151) in the Western Cape. The results from the study revealed that teachers complained that they were not getting enough technical support when using ICTs in schools. They complained of waiting more than three weeks before they can get just a light bulb for a smart board to be replaced or fixed by a technician. Therefore, in the absence of a smart board, teachers could not use ICTs for teaching and learning in the classroom (Rabah, 2015:24).

The integration of ICTs in schools can only be successful provided there are favourable ICT-related conditions. These conditions include the availability of an ICT coordinator at the school to assist teachers with technical support and support in making sure that relevant pedagogics for the adoption of ICTs are adopted (Mhlanga & Moloi, 2020:6). In agreement, Towers and Oliver (2000:381) argued that quality technical support is key for maintaining teachers' confidence in the use of ICTs for teaching and learning in schools.

3.4.10 Financial Constraints

The adoption of ICTs in schools has put a heavy burden on school budgets. Therefore, not all schools can afford to buy computer hardware, software or to continuously upgrade the computers. Obviously disadvantaged schools will be seriously affected (Matyila, 2019:82). Nyathi's (2022:28) research in inclusive primary schools in Gauteng validates the findings by Keyembe and Nel (2019:79) which identified a lack of funding for the implementation of ICTs in South African schools as one of the biggest obstacles facing the country. This is worrying because ICT costs may cause unequal educational conditions in schools. The most affected are often learners from the disadvantaged schools.

3.4.11 Workload

There is need for adequate preparation before using ICTs in the classroom (Ghavifekr, Kunjappan, Ramasamy & Anthony, 2016:37). In agreement, Arends (2021:51) states that schools must support teachers by giving them enough time and technical support to prepare for ICT-enhanced lessons. In research conducted at a Chinese secondary school in Malaysia, it was revealed that some teachers could not use ICTs for teaching and learning due to high workloads (Raman & Yamat, 2014:11). The teachers complained of too much administrative work which contributed to their shunning the use ICTs for teaching and learning. The same teachers totally refused to integrate ICTs in their English lessons as they considered ICTs to waste their time. Their focus was to complete the syllabi and examinations rather than using ICTs for teaching and learning (Raman & Yamat, 2014:11). There were similar findings in public schools in Bartin City in Turkey. Research revealed that teachers complained that the preparations for ICT-enhanced lessons were time-consuming. The teachers also complained of not conducting their lessons due to technical challenges especially when it came to the use of smart boards (Özdemir, 2017: 505). For this reason, some teachers perceived the use of ICTs was a waste of time.

3.4.12 The Fear of Technology

Research has revealed that there is another intrinsic barrier when it comes to the use of ICTs in the schools. The barrier is fear of the computers or what some call technophobia (Chisango, 2019:129). For example, research conducted in Cape Town in disadvantaged schools under the Khanya project revealed that some teachers did not want to use computers for fear of making mistakes in front of the learners. Therefore, teachers resisted the use of ICTs for teaching and learning (Tigere, 2020:55). This is supported by Ngobe (2023:65) who assert that teachers who are not confident in the use of ICTs are reluctant to use computers in the classroom. It can be concluded, therefore, that only schools with teachers that are confident in the use of ICTs can benefit from the use of technology for teaching and learning. Moreover, such schools are more likely to embrace the use of ICTs for teaching and learning in their schools. Conversely, the teachers who do not value ICTs and are fearful of using them in the classroom, will have challenges when it comes to the adoption and using of ICTs in their schools (Tigere, 2020:55).

3.5 HOW TO OPTIMISE ICT USE IN CLASSROOMS

There is a need for teacher support in order to get the most out of the use of ICTs in classrooms. This is important in areas where there are limited resources. Therefore, there is a need for a rigorous drive to conscientise teachers on the positives of using ICTs for teaching and learning. This will make sure that schools are provided with appropriate ICT technological solutions are of paramount importance. Buda (2020:159) clearly states that put when it comes to the use of ICTs, there is a difference between teachers who choose ICT resources to enhance understanding of certain topics, and those who choose ICT resources merely to present students' work in a new way without any direct application to the topic. Therefore, when teachers use their pedagogical knowledge on both the subject and on how students understand and learn the subject, they can optimise the effects of using ICTs by increasing students' attainment. However, the implementation of these technological solutions should be context-specific and adapted to the needs of schools in question (Agbo, 2015:71). Consequently, the focus should be on making sure that ICT initiatives are sustainable, effective and able to meet the demands of users. Simultaneously, potential users must have a sound understanding of how to use new ICTs to their benefit and have a cultural view of the relationship between learning and technology (Shuro, 2020:8).

For Hansen, Postmes, Bos and Tovote (2009:34), there are many different types of technologies that can be used to support and enhance learning. However, the choice of these different technologies must not be guided by low cost, low energy and low maintenance. Instead, the focus must be on flexibility in terms of mode, timing and location use. Technology must be placed firmly in the learners' hands to increase their motivation and time spent on learning. More emphasis must be on the use of mobile phones since they are the only widely available technology with a great deal of promise, especially in places without adequate electricity and internet connectivity like the rural areas. Although the use of mobile phones has some technical limitations and security issues, several mobile learning pilot projects are currently taking place and are seen to be contributing positively to learner achievement (Shuro, 2020:49). Furthermore, Mfupi (2020:84) explains how each technology plays a different role in the learning process, how it should be used in the classroom and why it is used. This is important because literature has established two general distinctions. One distinction is that students can learn where computers are used essentially as tutors to increase their basic skills and knowledge. The other distinction is that learners can also learn with computers where technology is applied to a variety of goals in the learning process, and that technology is used as a resource to help develop higher-order thinking, creativity and research skills (Mfupi, 2020:13).

3.6 HOW THE USE OF ICTS IMPACTS THE TEACHER

According to research studies and initiatives by the Digital Education Enhancement Programme (DEEP) carried out by an Open University team over two years in primary schools in rural, disadvantaged areas of South Africa, ICT use enhances teachers' professional knowledge and capabilities in very specific ways (Ventouris, Paourgia & Hodge 2021:2). It was further established that the use of ICTs extends subject knowledge, makes planning and preparation for teaching easier while developing teachers' existing pedagogical practices.

In the studies by the DEEP, teachers were provided with professional ICT toolkits comprising of high-quality multimedia materials, classroom resources and planning tools which included a computer, laptop, digital audio-visual equipment and accessories. (Makaring, 2023:21) The focus was on the use of these ICT resources in different contexts, teacher access to adjacent technologies, geographical location, cultural practices, home language and teacher subject specialisation. It was believed that using ICTs would facilitate new forms of teacher-to-teacher cooperation that would address their different challenging circumstances. The perceived challenges included, among other things, large class sizes, a lack of electricity and telephone connectivity, heating and a lack of other resources. However, despite these challenges, most teachers were highly motivated in making sure that they succeeded in using ICTs for their own development and for their learners in the learning process. Some positive outcomes showed considerable improvement in literacy, numeracy and science learning by students. Furthermore, the most successful uses of ICTs were witnessed in educational and pedagogical principles when teachers, schools and the education system showed some quality results and an improvement in teachers' confidence in the use of ICTs (Lasut & Bawengan, 2020:1).

3.7 THE IMPACT OF ICTS IN THE TEACHING AND LEARNING

The introduction of ICTs into the classroom had a huge impact on the practices of teachers, particularly when ICT is conceptualised as a tool that supports a real change in the pedagogical approach. The introduction of ICTs meant that teachers were not only expected to change their roles and classroom organisation, but also invest their energy in developing themselves and their learners in preparing for the introduction and management of new learning arrangements brought about by the use of ICTs in the classroom (Ventouris et al., 2021:4) The use of ICTs in the classroom demands that teachers determine suitable applications that will add value to learning and teaching in their subject areas (Hafifah & Sulistyo, 2020:186). Consequently, teachers should know that this should not be a one-time activity, as IT is continuously changing. Even the way they assess tasks can be impacted since they will be moving away from summative methods of assessment to formative approaches and open-ended products (such as reports and research papers created by groups of students). However, this could be time-consuming and result in an increased teacher workload but rewarding in the end (Makaring, 2023:33). Therefore, if teachers are to reap the rewards of using ICTs in the classroom, emphasis must be on encouraging the same teachers to identify good practices on the web that they can apply in their classrooms and to share resources with other teachers (Khosa, 2020).

Furthermore, teachers also need to understand that using computers does not necessarily mean extra work but may reduce their workload. The use of ICTs in the classroom demands that teachers demonstrate a high level of energy, hard work and perseverance (Makaring, 2023:10). The same views are shared by Kehdinga (2019:35) in arguing that the use of ICTs requires teachers to be highly resourceful. They go on to state that the use of computers by teachers in the classroom requires that they work closely with available resources that will supply them with ideas and materials for different classroom applications (Prait, 2017).

3.8 THE TEACHER'S ROLE IN FACILITATING AND INTEGRATING ICTS

The changing landscape of communications and information exchange in the twenty-first century requires teachers to keep abreast of knowledge production and application of information rather than consumption. They need to prepare themselves by making sure that they are adequately educated in the use of ICT. This is important because in many developing countries most teachers have limited or no ICT skills themselves, which becomes a limitation for them to impart the same to their learners. Therefore, teachers need considerable support for ICT integration into teaching and learning so that they can be effective and simultaneously have a greater impact on their learners (Scherer, Siddiq & Tonndeur, 2019:13). Research carried out in the Northern hemisphere context on teacher learning suggests that traditional, one-off external in-service workshops tend to be of limited value when it comes to sustainable teacher development (Ramavath, 2020). Similarly, multiple efforts in South Africa over the last decade to introduce ICTs in schools that are outlined in the Infodev[4] which offers a database of such activities have failed to live up to their aspirations. This was mainly because of their top-down nature and insufficient attention given to teachers. However, research shows that a more promising way forward is a sustained professional development programme that creates teachers' local professional communities and encourages ongoing peer learning by teachers of similar subjects and age groups (Maring, 2023:77).

Recently, in the administrative region of the canton of Vaud in Switzerland, an evaluation of a large-scale in-service K-4 teacher training programme was carried out. This was a computer science and robotics integration model for primary schools where approximately 350 primary teachers participated in the mandatory continuing professional development programme. The expectation of the programme was to close gaps in teachers' ICT skills (El-Hamamsy et al., 2021:2460). This initiative was the most successful model that proved to be an 'organic' approach since it provided school-based training of robotics to teachers. In this model, teachers were trained largely using the face-to-face approach. It included a module that assisted teachers to evaluate the impact of ICT on learning. Most teachers received training in their own schools using the schools' equipment and resources. The training was supplemented with workbooks used by teachers for group work assignments. The principles of the model were derived from successful characteristics identified in the literature and were validated in many studies including cultural contexts (El-Hamamsy et al., 2021:2469).

Research has indicated that it is possible to change the way teachers teach in the classroom. Teachers can take the advantage of technology to support more student-centred approaches used for instruction, help to develop higher-order skills, and simultaneously, promote collaborative activities (El-Hamamsy et al., 2020:2452). However, many countries in the world have acknowledged the importance of ICTs by making available various degrees to provide teachers with ICT training although many teachers still complain that they do not have adequate training from this initiative and are still feeling unprepared and ineffective when using technology for teaching and learning. Many countries made sure that they effectively use technology to train teachers on how to use the same technology as tools of teaching and learning (Ghavifekr et al., 2016:37). The same sentiments were echoed by Collis and Jung (2003:171) who assert that ICT teacher training can take many forms. Teachers are either trained on how to use ICTs or they can be trained via ICT.

3.9 DIFFERENT MODES OF TEACHING AND THE USE OF ICTS

The introduction of ICTs has brought about new methods of teaching. In the past, the traditional methods of teaching confined learning within the classroom walls. However, ICTs have now provided alternative ways to teaching and learning. These new teaching methods brought by the adoption of technologies are blended and online learning (Umugiraneza, Bansilal & North, 2018:342). The teaching methods are discussed in detail in the paragraphs that follow.

3.9.1 Traditional Teaching Mode

Before looking at blended and online learning, it is paramount to first explore the traditional teaching mode, so we get an understanding of what it is all about. The traditional teaching mode is teacher-centred. This teaching mode holds that teachers are the fountains of knowledge while learners are mere receivers of knowledge (Maisela, 2021:20). The traditional teaching mode bases assumes that learning can only take place in class and learners must sit and listen to the teacher who is regarded as the source of knowledge. In this teaching mode, the teachers get feedback from the learners in the form of tasks done, homework or from examination results. It is believed that if there are clear rules to be followed by learners, good time management and good behaviour in the classroom, learners are likely to succeed (Adams, 2014:1).

The teaching method uses face-to-face courses for students who want to build a rapport with their peers and lectures (Lauver, Drum, Windsor & Miller, 2013:113). This teaching method holds that if learners are in a classroom setup then social awareness is natural since learners observe reactions of other learners and instructors. Furthermore, interaction with fellow classmates is very easy in the traditional teaching mode (Ahmadi, 2018). Therefore, a traditional teaching mode requires that there must be physically arranged desks, a blackboard, audio-visual equipment and obviously a teacher.

When using face-to-face mode in the traditional teaching mode, the teacher relies on learners' body language and facial expressions for feedback (Onyejeakor, Eze, Onyeagam & Adegboyega, 2020:1357). The research conducted at the Memorial University of Newfoundland in Canada affirmed what Wuensch et al. (2008:523) echoed. The research was conducted on students who were taking on-campus courses and it was revealed that the students acknowledged the power behind being in another's presence, allowed them to use non-verbal communication (Delaney, Johnson, Johnson & Treslan, 2010:46).

However, since the traditional mode is confined to the classroom, some learning institutions are now blending it with ICTs. This allows learning to be extended beyond the classroom (Zungu, 2022:4). It has also been found that whenever technology is used is used collaboration during face-to-face teaching is enhanced. For example (Shuro, 2020:17) argued that teaching in some subjects such as Mathematics and Biology was done using pocket personal computers interconnected through Wi-Fi. Furthermore, Ngobe (2023:24) states that when learners use these handheld computers, it allows members of the learning group to engage in meaningful social interaction. This is done when learners can simultaneously use tools such as Google docs in the classroom to create content.

Learners can be asked by the teacher to respond simultaneously to certain-to-certain academic issues using a centralised Google doc. This promotes discussions since student can post their thought anonymously. Besides using Google docs, learners can also use other tools like the interactive whiteboards to complement traditional modes of teaching (Davidovitch, 2017; Yavich, 2017:60). For Davidovitch and Yavich (2017:60), the use of interactive whiteboards in the classroom is a good presentation tool since it has the potential to reach all learners simultaneously. Simultaneously research has revealed that the use of these interactive whiteboards helps to promote learners' engagement with ICTs and, simultaneously, motivate and promote their interests and participation in class during teaching and learning (Aytac, 2013:1907). This means that the traditional mode of teaching has been blended by ICTs to afford learners and teachers a more flexible and dynamic interaction process (Lu & Price, 2018:2907).

3.9.2 Blended Teaching Mode

Vallée, Blacher, Cariou and Sorbets (2020:1) describe blended learning as combining face-to-face teaching with technology-enhanced instruction in the teaching and learning process. In blended learning, teachers and learners still meet in the classroom just like in the traditional mode. However, in the blended mode, the teachers meet in the classroom with learners but electronic devices such as tablets, smart boards and computers are also used to aid the teaching and learning process (Lu & Price, 2018:2907). While blended learning includes technologies in the teaching and learning, it totally changes the role of the teacher (Pool, Reitsma & van den Berg, 2017:153). In blended teaching, the teacher assumes the role of educational facilitator rather than knowledge dispenser. Simultaneously, learners are affected since they now assume the role of active participators in the learning process rather than being passive recipients of knowledge from the teacher. This means that in the blended mode, learners become active participants in their own learning (Pool et al., 2017:153).

In blended learning, there is a combination of synchronous and asynchronous elements (Ostrowski, Windeatt & Clark, 2017:261). Synchronous element is described by Norberg et al.

(2011:207) as face-to-face meetings, video conference meetings and chats. Consequently, asynchronous elements are described as elements that include recorded lectures, discussions and collaboration. Therefore, blended learning affords people from different locations and time zones to interact. By using ICTs learners can upload assignments on LMSs and engage simultaneously in discussions using the same learning platforms. Moreover, it is not only learners that benefit from blended learning. It is also true that if learning institutions of higher learning offer blended learning and online courses to students, some students especially postgraduate students will benefit from this since most of them are full-time employees who need to balance work and studies (Vallée et al., 2020:1).

Poon (2014:154) maintains that the implementation of blended learning requires certain factors to succeed. One of the factors is equipping learners with ICT skills that will enable them to navigate ICT tools used in blended learning like LMSs. On the other hand, teachers also need to be trained on how to use ICTs for curriculum delivery. Simultaneously the institution has the responsibility to provide teachers and learners with all support they need for blended learning to be carried out successfully (Kumar et al., 2021:9). Blended learning can use ICTs that include Web 2.0 technologies. These technologies include wikis and social networking sites like Facebook, video sharing, YouTube, WhatsApp and others (Bower, 2015:350). All these tools according to Web 2.0 are effective for online learning and make learners active participants in the teaching and learning process and not passive receipts of information (Kumar et al., 2021:85152). Furthermore, research findings from the Greek primary and secondary schools affirm these claims (Palaigeorgiou & Grammatikopoulou, 2016:2). When Web 2.0 was introduced in Greek schools, it emerged that learners became very creative and managed to publish their work. There was great interaction between learners of social platforms like Facebook, where they shared lessons notes and so on. Simultaneously, teachers were able to create videos and even post them to learners. These afforded learners the opportunity to comment on the videos and this encouraged discussions later in class on the same topics from the videos. Learners were also able to analyse the videos and share their opinions with peers via social platforms (McLoughlin et al., 2016:28). This was positive as it encouraged learners to critique each other while simultaneously promoting discussions with peers.

However, regardless of all the advantages that were brought by Web 2.0, some teachers were not convinced with these advantages. Some teachers argued that there was an oversight on the limitations and weaknesses institutions of learning. Research revealed that the challenges that were faced by the learning institutions were categorised into two, external and internal barriers

(Palaigeorgiou & Grammatikopoulou, 2016:2). The external barriers included ICT training, access and technical support. The internal barriers include teachers' attitudes, and their beliefs in technology (Marchalot et al., 2018:411). Nevertheless, all these barriers can be overcome by making sure that schools are provided with the ICT tools they need, that all learners have access to ICTs, good connectivity, teacher training and technical support. On the other hand, successful implementation of blended learning relies on the learners' ability to manage time. Nevertheless, the study of Smyth, Houghton, Cooney and Casey (2012:464) on the experience of students who took a blended learning course in nursing and midwifery at the National University of Ireland revealed that time management skills were lacking with some of the students. Learners did not want to take responsibility for their own learning. Consequently, some learners felt that blended learning gave them less opportunity for social interaction with their fellow students (Smyth et al., 2012: 464).

Another study on blended learning was conducted by Poon (2014:154) in the UK and Australia on blended learning. The study revealed that academics were facing challenges. The main challenge that academics faced was that of not coping with the rapid changing technology. Academics were also faced with connectivity issues especially in remote areas of Australia. As for the UK, no academics were able to participate in online teaching and learning activities because of an attitude problem (Poon, 2014:154).

3.9.3 Online Teaching Mode

The online mode for teaching and learning is an approach that makes use of the internet for communication and collaborating in education (William, 2016:119). The mode provides a two-way communication system which allows learners to communicate with their peers and with their teachers. This is done using Web technologies to distribute content. By using the online mode, learners are afforded the opportunity to do distance and personalised learning. Furthermore, online learning has an added advantage of being able to keep learning material up to date by simply uploading it on the server so that learners can immediately have access to the learning material (Adan & Anwar, 2020:45). Using the online mode also makes it possible for learners to achieve high-quality online experiences provided the teacher uses stimulating and active teaching methods (Sebaaly, 2018:163). Therefore, the teachers must make sure that they use activities that promote collaboration, communication and inquiry when using the online mode (Huynh 2005; Redpath 2012:125). For Moeller and Reitzes (2011), learners can only be motivated to become creators of knowledge and to be problem-solvers provided there is access to ICTs and resources. This is supported by Johannes (2007) who conducted a study at a Technical High School in Soshanguve. The study revealed that learners who took online courses in entrepreneurship, improved in their learning, creativity, innovation and creative thinking. Learners were able to produce products using their entrepreneurship skills.

On the contrary, research conducted at the University of Bhutan revealed that there was a limited use of LMSs and their features by teachers even though teachers were trained on how to use these LMSs. The main features that were used were the uploading of assignments and module descriptors (Penjor, Dupka & Zander, 2016:71). It was also indicated by some lecturers that there was not enough time to prepare and upload learning materials on LMS. They also cited limited skills and poor connectivity as another cons factor that hinders effective use of the LMS (Penjor et al., 2016:71). For Xiao (2017:124), effective use of online teaching can only take place provided three interaction types are catered for. The three interaction types are learner-content interaction, learner-instructor interaction and learner-learner interaction., meaning there is time when learners only need to interact with online content, time they must interact with the teacher and time they need to interact with their peers. Teachers could use discussion forums to enable learners to make contributions through texting in groups (Bower 2015; Njoku, 2015:22).

Although it is argued that using all the three types of interaction contribute immensely to effective online teaching, there is a need to make sure that things like communication, flexibility, feedback, learners' roles, teachers' roles and the quality of online courses are attended to (Vallée et al., 2020:2). A study by Zungu (2022) at the University of KwaZulu-Natal revealed that all participants appreciated the benefits that online courses brought to their learning. However, they felt that communication by their teachers on online courses was not that effective (Zungu, 2022:18). Some indicated that the response turnaround time by teachers was a major concern. However, a large number of students at the university appreciated that online teaching had changed the way they previously viewed learning for the better.

The findings from Zungu's study were, however, at odds with an earlier study by Arbaugh, Godfrey, Johnson, Pollack, Niendorf and Wresch (2009:71) which explored student satisfaction with online learning. The results from this study revealed that there was a need for human interaction and that it was not enough and not effective to only upload information on LMSs. The reason was that some learners were not able to learn on their own (Ladyshewsky & Taplin, 2014:316). Therefore, one can conclude that the results from Zungu's study show that there is a big improvement in online learning and more learners are now embracing it. For this reason, more institutions of learning are modifying traditional methods of learning to blend them with online learning (Kumar et al., 2021: 85152).

3.10 CHAPTER SUMMARY

The chapter provided information on how ICTs were introduced in education to enhance teaching and learning in schools. The chapter also looked at the achievements, impact, benefits and challenges that were faced in the implementation of ICTs in education in general. The chapter explored the different teaching methods that are used and how these methods incorporate ICTs in the teaching and learning process. The chapter revealed that the use of ICTs in the world has taken the centre stage. Without doubt, the use of ICTs is being embraced by nations of the world. Most countries, particularly in Africa, have come to realise that there is indeed inequality when it comes to the distribution, access and sharing of ICTs. This has caused a digital divide within societies. The digital divide has in turn made the adoption and use of ICTs in teaching and learning very problematic. In developing countries, including South Africa, the role of ICTs in institutions of learning has led to educational authorities to consider best ways of dealing with the consequences of this digital divide. This can only be achieved if countries use better and more efficient methods when it comes to use of ICTs. This will, in the end, benefit and improve learner and teacher performance in schools. In this case, that is the context of this study.

CHAPTER 4

RESEARCH METHODOLOGY AND DESIGN

4.1 INTRODUCTION

This chapter focused on a number of important issues that form the basis of this study's research design and methodology. The important issues include conception of research methodologies, such as mixed methods research, quantitative research and qualitative research used to collect data from five secondary schools in Soweto. The chapter outlines the nature of mixed methods research. Focus was also on giving a detailed account of the population and sampling techniques of the study. It also describes step-by-step procedures in designing the instrumentation simultaneously describing data collection techniques, how data collected in this study was managed and how the statistical data were analysed, using the SPSS. The chapter outlined the reliability and validity strategies adopted in this study. Finally, the different ethical considerations employed in the study were examined.

4.2 RESEARCH PHILOSOPHICAL ASSUMPTIONS AND PARADIGMS

Researchers tend to bring a set of beliefs and philosophical assumptions in any study that shape the direction of the research. In all research, be it qualitative, quantitative or mixed methods research, there are underlying philosophical assumptions. These assumptions can be ontological assumptions or epistemological assumptions that are linked to the methodology that is chosen for the study (Antwi & Hamza, 2015:219). The different knowledge claims or paradigms on which researchers base their assumptions on what and how they will conduct a research project are shown in Figure 4.1 (O'Reilly & Kiyimba, 2015:23).

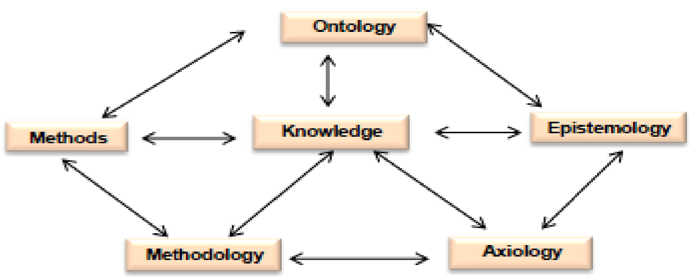

Figure 4.1: Positivist, interpretive and constructionist paradigms

Source: Adapted from O'Reilly & Kiyimba (2015:23)

O'Reilly and Kiyimba (2015:23) describe ontology as a dimension that specifies the nature of reality that is to be studied and what is already known about it. Epistemology is also described as a dimension that specifies the nature of the relationship between the researcher and what can be known. On the other hand, methodology is described as a dimension that specifies how researchers may go about to practically study whatever they believe can be known.

Therefore, in this study, the researcher's intention was to establish how best the DBE can promote effective use of ICTs to improve learner and teacher performance in Soweto public secondary schools. The researcher was concerned with the realities of the effectiveness of using ICTs in promoting learner and teacher performance in Soweto secondary schools. This reality consisted of learners and teachers' improvement in performance regarding effective use of ICTs, hence open-ended questions and interviews were used to collect data. This was an ontological assumption (interpretive paradigm) which is supported by Scotland (2012:9) when he asserts that "researchers need to take a position regarding their perception of how things really are and how things work". Perhaps the most specific ontological question that the researcher sought to answer was: what is the GDE doing to promote the effective use of ICTs to improve learner and teacher performance in Soweto secondary schools?

As for the dimension of epistemology which deals with the relationship between the researcher and what can be known, the most relevant question that the researcher could have posed would be: how effective is the use of ICTs in improving learner and teacher performance in Soweto secondary schools? According to Antwi and Hamza (2015:219), epistemology poses questions such as "What is the relationship between the knower and what is known? How do we know what we know? What counts as knowledge?" Therefore, the study used both qualitative and quantitative approaches simultaneously for data collection to support and enhance the findings of each approach. Both positivism and interpretivism were used since they have unique ontological and epistemological assumptions. Furthermore, this study "conceptualised qualitative and quantitative meta-theoretical assumptions concerning the nature of knowable or reality (ontology), view on truth and legitimate knowledge (epistemology), and how the inquirer finds out knowledge (methodology)" (Antwi & Hamza, 2015:217). A comparison of all four paradigms is shown in Table 4.1. It clearly tabulates how paradigms such as positivism, interpretivism and constructivism differentiate the nature of enquiry, namely: ontology, epistemology and methodology that researchers use.

Table 4.1: Positivist, interpretive and constructionist paradigms

	Ontology	Epistemology	Methodology
Positivist	• Stable external reality • Law-like	• Objective • Detached observer	• Experimental • Quantitative • Hypothesis testing
Interpretive	• Internal reality of subjective experience	• Empathetic • Observer Subjectivity	• Interactional • Interpretation • Qualitative
Constructionist	• Socially constructed reality • Discourse • Power	• Suspicious • Political • Observer constructing versions	• Deconstruction • Textual analysis • Discourse analysis

Source: Adapted from Terre Blanche, Durrheim and Painter (2006:6)

4.3 RESEARCH DESIGN AND APPROACH

Kumar (2011:94) argues that "a research design is procedural plan that is adopted by the researcher to answer the questions validly, objectively, accurately and economically". A research design gives a simplified view of the research components such as data collection methods, study type and the analysis plan (McMillan & Schumacher, 2014:16). In other words, a research design is a strategy for action through which the research questions will be addressed effectively while a research method describes how data is collected and analysed to answer the main research question, optimally. Leedy and Ormrod (2018:464), Mbilinyi and Mwabungulu (2020:489), and Selltiz, Deutsch and Kumar (2011:94) concur that research design refers to a plan and schedule for collecting and analysing of data in a manner that aims to combine relevance to the research purpose with economy in procedure. Consequently, Thomas (2009:71) submits that research designs should address questions such as what the study is trying to address and whether the results can be used practically. All the above definitions sum up research design as a plan that considers the researcher's expectations and context. Therefore, for the main research question to be answered with conviction, accurately, validly, objectively and economically, the researcher had to combine the quantitative and qualitative methodologies. When both qualitative and quantitative approaches are used in a single study, it can be regarded as a mixed method study.

Mixed method research is a procedure for data collection, interpretation and analysis. Guetterman and Fetters (2018:903) described this approach as a single-phase design which allows both qualitative and quantitative data to be collected, analysed and integrated in order to compare and relate data from the two. Creswell and Creswell (2018:352) concur that the use of the mixed method approach permits the collection and analysis of qualitative and quantitative data separately and then merge the results in order to compare them. Hammarberg, Kirkman and Lacey (2016:499) assert that when both qualitative and quantitative approaches are used, one research problem becomes clearer and better understood. In the same vein, Guetterman and Fetters (2018:903) averred that the use of mixed methods approaches is viewed as a strength when conducting research in education since the combination of qualitative and quantitative is viewed as complementary. Ary, Jacobs and Sorensen (2010:561) concur in reiterating that using both approaches can expand and broaden the depth of a study. However, one should take into consideration that both perspectives have strengths and limitations. For this study, the researcher chose to use the mixed method approach based on the assumption that more insight would be gained by using the combination of both quantitative and qualitative research as compared to only using one method. Creswell (2014:232) asserts that using the combined approach provides an expanded understanding of the research problem. Furthermore, Creswell (2018:352) agrees that mixed methods research uses parallel or sequential designs where quantitative and qualitative data are analysed in an integrated manner to answer related aspects of the same research question.

A quantitative methodology is informed by a positivist paradigm while a qualitative methodology is based on the interpretivist paradigm (Alghamdi, 2015:2). Positivism as a paradigm views experimentation, observation and reason based on experience as exclusive when one wants to understand human behaviour (Kivunja & Kuyini, 2017:30) According to McMillan and Schumacher (2010:15), humans must be studied in the same way as the study of nature, hence the use of positivism. This is because scientific knowledge is regarded as facts and reality and seen as independent of social construction. The positivists believe that the world is a fixed entity whose mysteries are not beyond human comprehension, meaning that their findings are always quantitative, statistically significant and generalised (McMillan & Schumacher, 2010:15).

4.3.1 Rationale for Mixing Methods

The mixed methods research is perceived as pragmatic in nature since it uses two different research approaches with different designs that are based on different philosophical/theoretical contexts (Mahato, Angell, Van Teijlingen & Simkhada, 2018:45). When both approaches are used in a study, it is believed that the research gains legitimacy and popularity in social and human sciences. Guetterman and Fetters (2018:903) argue that using both quantitative and qualitative data within one study helps the researcher to capture trends and details of the phenomena more effectively than using one method on its own. Yin (2018:54) stresses that research done through mixed methods research has an advantage over using a single method since it tends to be more intensive and robust. Furthermore, when the two are used together, they allow for a more robust analysis as they complement each other while taking advantage of each methodology’s different strengths (Creswell & Creswell, 2018:352; Green, Caracelli & Graham, 1989:259; Miles & Huberman, 1994; Tashakkori & Teddlie, 2003:12). However, Tashakkori and Teddlie (2008:103) argue that most researchers who do mixed methods research do not always recognise the reasons behind this.

4.3.2 How to Use Mixed Methods Research

Designing a mixed methods approach in research requires several steps to be taken into consideration. These steps among other things include formulation of research questions, how to deal with the purpose of the study, and the type of data to be collected (Creswell, 2014:41). In addition, there are four additional steps involved in mixed methods approach. The additional steps are the identification of the data, making decisions on the data collection procedures, making decisions on whether to use an explicit theoretical lens, and the identification of data analysis and integration procedures (Barnes, 2019:303).

The first step requires the researcher to take into consideration whether the research will use an explicit theoretical lens that underpins the study of the researcher and subsequent methodological choices (Molina-Azorin, 2016:37). In the second step, the researcher is required to decide on how data collection will be implemented and prioritised. In this step, the researcher is expected to map out a strategy on how they are going to concurrently collect qualitative and quantitative data (Creswell & Plano Clark, 2007:7; Morgan, 1998:370). In the third step, the researcher should determine the point at which data analysis and integration may occur. This can be achieved through separate analysis of data, transforming and connecting the analysis (Courtney, 2017:202). When quantitative and qualitative data are analysed and compared separately, the researcher can contrast the two sets of results. By doing so, the researcher can focus on the themes that emerge from qualitative interview data and ultimately compare them to the quantitative survey data (Creswell 2014: 41).

4.4 A QUALITATIVE APPROACH

The qualitative approach was used as the study focused on what was happening in the real world of teachers (Kivunja & Kuyini, 2017:26; May 2002:221). Authors like Bertram and Christiansen (2016:138) concurred that the use of the quantitative approach helps respondents describe their everyday experiences. For this research, the use of the quantitative approach helped respondents describe their everyday challenges relating to support strategies they get to overcome and manage challenges encountered in the implementation of e-learning innovation in their respective schools. Alase (2017:11) argues that qualitative approach allows multiple participants experiencing similar events to tell their story without any distortion. Suter (2006:41) emphasises that the use of qualitative approach in research mainly focuses on the use of verbal descriptions rather than testing hypothesis with numerical values to explain complex phenomena. Kumar (2014:94), and De Vos (2002:84) agree that the qualitative approach enables the researcher to describe and understand a phenomenon from the point of view of the participant’s everyday social life. Therefore, the use of the qualitative approach allows researchers to collect varied in-depth hidden information that is beyond the person’s surface behaviour, beliefs, expectations and intentions (Kabir, 2016:201). Furthermore, Leedy and Ormrod (2005:33) and Johnson, Adkins and Chauvin (2020) argue that qualitative research is an interpretive approach that can answer questions on complex phenomena. Consequently, the qualitative research approach is flexible and allows the researcher to collect data using methods such as semi-structured interviews, focus group interviews and documentary analysis (Du Plooy-Cilliers, Davis & Bezuidenhout, 2015:174). Creswell (2014:41) and Creswell and Poth 2018) concurred that qualitative research is an approach to enquiry that relies on verbal, visual, tactile and auditory data. However, in this study, not all the above-mentioned approaches to inquiry were used. The researcher mostly relied on the verbal, auditory data and visual approaches through the use of face-to-face interviews. Data was preserved in descriptive narratives like recordings and written records. In this approach, the researcher used a recorder to record responses and wrote some responses in a book. This is because qualitative research is the most appropriate approach to use when researchers want to collect data in face-to-face situations by interacting with selected persons in the settings (Lemon & Hayes, 2020:604; Mantshiyane, Setlalentoa & Phindane, 2020; McMillan & Schumacher, 2014:31).

4.4.1 Qualitative Research’s Guiding Assumptions

Mhlanga and Ncube (2003:29) and Gioia (2020:22) point out that a qualitative research approach requires specific conditions to be met before it can be effectively undertaken. Schram (2003:7) outlined five key guiding assumptions that underline qualitative research. The first key guiding assumption is that the researcher uses the qualitative approach when they are seeking to explore and understand the social world through people’s direct personal experiences in their actual settings (Gioia, 2020:22). For example, the aim of this study was an investigation on how learner and teacher performance can be improved through effective use of ICTs in Soweto secondary schools. Therefore, the researcher used the qualitative approach to understand what is really happening in secondary schools in Soweto regarding learner and teacher performance in relation to ICT use. This was important because the qualitative approach afforded the researcher the opportunity to explore and understand learners and teachers’ direct personal experiences regarding their performance in relation to ICT use. Lemon and Hayes (2020:604) concurred that social research aims to capture the character of naturally occurring human behaviour through firsthand contact with it. Therefore, it was important that the researcher minimised his influence on the behaviour of the participants.

The second key guiding assumption is that a qualitative approach enables researchers to comprehend that knowledge construction is interactive in nature and is punctuated with interplay of subjective views (Mhlanga & Ncube, 2003:29). Therefore, it was important for the researcher to engage in personal encounters with the participants and exchange views with them on how ICTs can effectively be used to improve learner and teacher performance in Soweto secondary schools. This helped the researcher develop a qualitative understanding of the phenomenon.

The third guiding assumption is that the investigation into the social world calls for the researcher to be sensitive to the socioeconomic and political context prevailing in South Africa (Gioia, 2020:22; Mhlanga & Ncube, 2003:29). For this study, the researcher had to take cognisance of the fact that South Africa is a young democracy that is still trying to correct the imbalances that were caused by apartheid in the education system. For this reason, most schools in the township could be lagging behind in terms of effective use of ICTs to improve learner and teacher performance. The reason could be that Soweto schools were the epitome of racial segregation because it was an area for blacks only during the apartheid era. The fourth key guiding assumption calls for attentiveness and patience with participants so that findings can be both specific and contextual (Gioia, 2020:22). For example, the researcher had to make some adjustments to his programme to suit the convenience of all participants when carrying out interviews and administering questionnaires.

The last and fifth guiding assumption of the qualitative research is that an empirical investigation is fundamentally interpretive (Mhlanga & Ncube, 2003:29). Therefore, the researcher had to ensure that unclear points and misunderstandings from the interpretation or presentation constructed of participants' experiences and behaviour were resolved and synchronised. Therefore, qualitative research is generally based on the relativist constructivist ontology that points out that there are multiple realities constructed by human beings who experience a phenomenon of interest and that there is no objective reality (Neuman, 2006:12). In addition, Kemmis and McTaggart (2000:597) assert that qualitative research has the aim of helping respondents to recover from the constraints of unjust and unsatisfying social structures of organisations, which tend to inhibit their self-development and self-determination. Since qualitative data are non-numerical, not depicting views, opinions or values, the main aim of qualitative data seeks to answer questions such as 'Why?' and 'How?' and it can also capture 'lived experience' of research participants (Carroll & Rothe, 2010:3480). Johnson and Christensen (2008:338) agree with the above statement that qualitative research is a naturalistic inquiry that advocates for the study of real situations as they unfold in the world. The characteristics that also guide qualitative research are summarised in Table 4.2.

Table 4.2: Characteristics of qualitative research

Characteristics	**Description**
Natural settings	Study of behaviour as it occurs naturally
Context sensitivity	Consideration of situation factors
Direct data collection	Researcher collects data personally and directly from the Sources
Rich narrative description	Detailed narratives that provide in-depth understanding Of behaviour
Process orientation	Focus on why and how behaviour occurs
Inductive data analysis	Generalisations are induced from synthesising gathered I information
Participant perspectives	Focus on participants' understanding, descriptions, labels and meaning
Emergent design	The design evolves and changes as the study takes place

Characteristics	Description
Complexity of understanding and explanation	Understandings and explanations are complex, with multiple personalities
Research paradigm	Constructivist and interpretivist

Source: Adapted from McMillan and Schumacher (2010:321)

4.4.2 Researcher-Participants' Relationship

The researcher for this study is an educator in a public school in Johannesburg and he investigated how effective use of ICTs in schools help in improving learner and teacher performance in Soweto secondary schools. This meant that the researcher was acting as an insider-researcher since he formed part of the system he was researching. This is in line with Unluer's (2012:1) assertion that insider-researchers are those who choose to study a group to which they belong.

The insider-researcher generally knows the politics of the institutions, the formal hierarchy and how the whole system really works (Unluer, 2012:1). Being equipped with all these advantages, the researcher knows how best to approach the people he wants to use for his research. Therefore, the insider-researcher has an added advantage compared to an outsider-researcher. An outsider-researcher could take longer time to collect data for the same study (Smyth & Holian, 2008:38).

4.5 QUANTITATIVE METHOD

Contrary to qualitative research, quantitative research uses numerical variables that are used to create statistical representations to test theory with the aim of measuring the social world objectively (De Vos, 2002:84). This approach's focus is on analysis and measurement of the casual relationships between variables (Creswell, 2014:4). Unlike the qualitative approach, this approach has large population samples and is often used for large-scale surveys using questionnaires to collect the data. Quantitative research is either descriptive or experimental. The two are different in that a descriptive study identifies associations between variables, while an experimental study identifies probable causality (Creswell, 2003:14; Ivankova, 2006:5). Leedy and Ormrod (2005:94) agree that quantitative research is an experimental approach where theories are objectively tested to examine to establish existing relationships between variables (Creswell, 2014:4). This is done by measuring, examining, numbering and analysing the variables stereotypically and statistically. Using this approach allows the researcher to answer questions while identifying relationships between measured variables in an attempt to explain, predict and control the phenomena (Migiro & Magangi, 2011:3762). For this study, simple descriptive statistics from SPSS were employed to interpret the data.

When using the quantitative approach, the assumption is that knowledge is universally correct even though the qualitative approach contests this view in research. The quantitative approach is rather numerical and seeks to answer questions like ‘how many?’ or ‘how frequently?’, and it often measures and reports on the data using a numerical scale. It also permits categorisation of pooled data, statistical analysis and mathematical modelling. For this reason, quantitative research is often regarded as objective, even though in reality the attitudes of the researcher about the phenomena have the potential to affect their measurement (Carroll & Rothe, 2010; 3480). When using the quantitative approach, the researcher tends to rely mostly on numerical data to test the relationships between the variables (Migiro & Magangi, 2011:3762). Therefore, the researcher can compare the variables to try and determine the magnitude and frequency of relationships. Bryman (2002:20) lists the following characteristics of quantitative approach:

a) It is a deductive approach used to determine the relationship between theory and research.

b) It incorporates practices and norms of the natural scientific model; and

c) It upholds the view that social reality is an external, and objective reality.

d) The use of the quantitative research approach is faster when reaching out to many participants.

e) The researcher is provided with the opportunity to compare responses of different participants through analysing the trends in the data collected.

4.6 POPULATION AND SAMPLING

4.6.1 Population

A population comprises many objects, events or individuals with common characteristics that the researcher is interested in studying (McDevitt & Ormrod, 2014:34). Mouton (1998:86) submitted that population is the sum-total of all the cases that meet the researcher’s definition. Furthermore, Babbie (2010:199) and McMillan and Schumacher (2014:16) describe a population as a group of elements, cases or individuals conforming to some specified criteria that researchers intend to use to generalise the research findings. Therefore, population is a requirement in any research regardless of whether it is qualitative or quantitative (Asiamah, Mensah & Oteng-Abanyie, 2017:1608). The research population for this study comprised of all secondary schools, teachers, principals and learners that use ICTs for teaching and learning in Soweto secondary schools. The secondary schools, teachers, principals, HoDs and learners were the target population for this research. Fraenkel and Wallen (2010:99) described the target population as that population the researcher would ideally use to generate their results. Hence, the researcher chose the target population mentioned here to apply the conclusions of the findings of this study.

4.6.2 Sample

Sample selection is one of the most important steps in any research. Sampling in research is referred to as a process of selecting individuals, institutions or organisations that will be used in the actual research (Kallie, 2015:60). All those who are selected for the study need to be anonymised and referred to as participants on commencement of the research. According to Neuman (2000:86), a sample is made up of those elements of the population of interest that are included in the actual study. However, White (2005:252) and Yin (2017:12) caution that if a sample is too large, it can make it difficult for the researcher to filter the analysis of data. Kallie (2015:60) concurs that a smaller sample works better. For this reason, the researcher limited his sample to only five secondary schools. However, the researcher must make sure that the size of the sample will not compromise the credibility of the results. Asiamah et al. (2017:1610) emphasise that the sample of a study must be specified, acceptable and representative of the population.

In qualitative research, there are varied sampling methods, which include purposive sampling, quota sampling, snowball sampling and convenience sampling, among others (Fraenkel & Wallen, 2010:99). Nonetheless, the sampling method is informed by the goals of the researcher and what they intend to achieve in the study. For the purposive of this study, the researcher used purposive sampling in selecting schools and participants (Babbie, 2010:193). Purposive research sampling is a form of non-probability sampling in which units to be observed are selected based on the researcher's judgement about which ones are most useful or representative (Babbie, 2010:193). Together the five selected secondary schools constituted a multiple case study. The researcher was able to collect relevant information regarding the promotion of effective and efficient use of ICTs to improve learner and teacher performance in Soweto secondary schools. This was done to answer the main research questions and the sub-questions. Selected schools were those with computer laboratories and computer tablets at their schools. School principals were included in the sample since they are ICT leaders who must ensure ICT integration in schools by executing ICT-related responsibilities (Fu, 2013:117; Kannan, Sharma & Abdullah, 2012:111; Papaioannou & Charalambous, 2011:353). Thus, it is the duty of school principals to make sure that teachers effectively and efficiently use ICTs in the teaching and learning process to improve learner and teacher performance in these selected township schools.

The researcher considered it prudent to study schools that already have ICT infrastructure, resources and teachers in Soweto secondary schools. The rationale behind choosing these schools is that the schools are already well-resourced and equipped with computer laboratories, tablets with functional software coupled with internet connectivity for teaching and learning purposes (Edmonds & Kennedy, 2017:208). The sample also involved the selection of the participants within the schools. The sampling process is described below.

4.6.2.1 Case selection

Purposive sampling was used to select five secondary schools from Soweto. Only public secondary schools were selected based on the uniform variable of having and using ICTs. The researcher had the liberty to select the "cases that illustrate the range of variation in the phenomena to be studied" (Gall, Gall & Borg, 2007:180). Therefore, the researcher used purposive sampling method to involve several cases that were used to represent the full range of values or the relationship between X and Y (Seawright & Gerring, 2008:300). The study focused mainly on two phenomena of interest, which were ICT use and its influence on the improvement of teacher and learner performance. Five public secondary schools were selected in Soweto to empirically explore these phenomena in detail. The five schools were identified because they already had ICT infrastructure, resources and teachers.

4.6.2.1.1 Selection of the qualitative method participants

The sample for the qualitative study comprised of 25 participants purposively selected to take part in the interview sessions. Their strategic roles, experience and exposure to ICTs in school guided the selection process. The targeted participants at each school were the principal or deputy principal, heads of department, two senior teachers and one ordinary teacher. However, in situations where some targeted participants were not available, the researcher interviewed some teachers who had experience of ICT. Only five participants from each of the selected five schools were interviewed.

4.6.2.1.2 Selection of the quantitative method participants

The proposed sample for the quantitative study was 150. The respondents consisted of 100 randomly selected Grade 11 learners (20 learners per school) and 50 teachers (10 teachers per school). The samples were drawn using random purposive sampling technique, where the first sampling involved first selecting clusters and then selecting individuals within the clusters (Gall et al., 2007:173). First, the researcher randomly selected 50% of learners from each Grade 11 class in the school and 50% of the teachers in the school. Then 20 learners were randomly selected per school in all five schools and 10 teachers were randomly selected at each school. The sampling frame used class lists of all Grade 11 classes at each school and a list of all teachers at each of the five schools selected. The information is presented graphically in Table 4.3.

Table 4.3: Proposed samples for quantitative study

Respondent group	**Number per school**	**Number of schools**	**Total**
Grade 11 Learners	20	5	100
Teachers	10	5	50
Grand Total			**150**

The participants were selected from five public schools in Soweto:

- 5 Principals or deputy principals (Interviews)
- 5 HoDs (Interviews)
- 15 teachers (Interviews)
- 50 teachers (Questionnaires)
- 100 learners (Questionnaires)

4.7 INSTRUMENTATION AND DATA COLLECTION

How one decides to collect data in any research is widely informed by the research's paradigm and the nature of the research question (Opoku, Akotia & Ahmed 2016:32). Therefore, the research question and the research design influenced the data collection of this study. The research question was "How best can the GDE promote effective use of ICTs or e-learning programmes to improve the performance of learners and teachers in Soweto public secondary schools?" The research design was a multiple-case, mixed-method study. However, it must be stated that for researchers to accurately respond to the research question, they need to make a choice from various data collection instruments (Johnson & Christensen, 2014:225). These methods include structured interviews, questionnaires, observations and document analysis. The use of multi-method approach in data collection is also echoed by Cohen and Manion (1980:208) who state that the advantages include:

a) The elimination of bias or distortion of the researcher's picture on what is being investigated.

b) Overcoming the problem of method-boundness using triangular techniques.

4.7.1 Semi-Structured Interviews

Semi-structured interviews were conducted with selected principals, teachers, HoDs and learners in line with the qualitative approach. The reason for using interviews was because they allowed the researcher access through words to an individual's actual experiences and realities (McDevitt & Ormrod, 2014:34). Furthermore, the use of in-depth interviews affords the researcher an opportunity to probe more and get more perspectives of participants' experiences or situations through repeated face-to-face encounters (Alshenqeeti, 2014:3, 9; Denscombe, 2009:141). McMillan and Schumacher (2014:53) submit that interviews have much a higher response rate, especially when dealing with personal qualities or negative feelings although this can prove to be time-consuming, coupled the lack of anonymity. Another disadvantage of the interview approach is associated with the high costs involved.

Open-ended questions were used for the semi-structured interviews to which the teachers had to respond, allowing the participants an opportunity to give their responses freely (Alshenqeeti, 2014:39). During the interviews, the researcher recorded the responses of the participants that were later transcribed. Recording helped the researcher recall everything that was said by the participants. Semi-structured interviews are also advantageous because they can be reasonably objective while simultaneously allowing the researcher to get a more thorough understanding of the participants' opinions and reasons behind their responses (Borg & Gall, 1979:313).

It is the responsibility of the researcher to make sure that the participants feel free and are allowed flexibility in their responses. Interviews were flexible in the sense that the researcher can use a mode of questioning that can be changed if the occasion demands it. Moreover, the respondents can ask for further information or clarity on questions being asked. In this study, the researcher adhered to the above by making sure that questions were rephrased if the questions were not clear to the participants. The semi-structured interviews that were employed by the researcher helped to collect data on the real experiences of participants on ICT practices, management support and learners' feedback. Creswell (2014:39) maintains that the use of semi-structured interviews is essential where personal attitudes, perceptions or beliefs of participants are needed.

The principals, HoDs and teachers normally have busy work schedules, and therefore, a combination of approaches was used for data collection. To ensure a high response rate, the researcher administered both the questionnaires and interviews face-to-face. During the preliminary visit, the researcher arranged for interview sessions with participants through the school principal. Simultaneously, the researcher arranged and explained to school principals how questionnaires were to be administered to the respondents. This was in line with Bowling's (2005:285) assertion that face-to-face administration and a combination of other techniques like follow-up, yield a higher return than using mail delivery.

Face-to-face, semi-structured interviews were used for principals and HoDs. Although they are time-consuming and costly, they are more consistent in data collection than non-personal methods (Bowling, 2005:285; Neuman, 2012:1). Furthermore, allow for more nuanced communication, deeper rapport building and real-time non-verbal cues, which can enhance the quality of data collected. The following procedure was adopted in the actual collection of interview data after selecting the participants for the interviews, developing interview questions and receiving ethics approval to carry out the research. The researcher:

- scheduled dates of interviews with the participants;
- made sure arrival times were adhered to, when going the venues to introduce himself and create a rapport with the interviewees;
- reassured the interviewees of confidentiality;
- obtained interviewees' approval to use recording devices;
- asked questions from the interview guide using probes and prompts to achieve clear and in-depth responses;
- recorded responses with recording devices (Adams, 2015:500; Leech, 2002:665). As Adams (2015:500) recommended, the researcher used small digital recorders and where

necessary, was more actively engaged in the conversation and also pondered the sequence of questions on responses given instead of just concentrating on writing down answers.

- asked for class lists of all Grade 11 classes and staff at each school to use for the purpose of sampling.

4.7.2 Focus Group Interviews

Focus group interviews are interviews where a group of participants in addition to the facilitator answer questions on a tightly defined topic for the joint construction of meaning (Bryman, 2001, 337). Focus groups offer an advantage as they enable participants to introduce additional topics that they find relevant and connected to the main discussion. Participants are also able to argue and challenge each other's views. Focus groups further offer the researcher the opportunity to study views of individuals collectively to make sense of a phenomenon. The only disadvantage of using focus group interviews is that there is less control over proceedings by the researcher, the data is difficult to analyse and organise and transcriptions of recordings are time-consuming (Bryman, 2001:339).

4.7.3 Questionnaires

The questionnaire is a quantitative data collection instrument. It is very economical since it allows the researcher to put the same questions to all participants and can ensure anonymity (McMillan & Schumacher, 2001:257). Furthermore, the questionnaire can reach a larger sample (Mason & Bramble 1997:316). In this study, selected learners and teachers from the five selected schools were given questionnaires. However, as much as possible, the researcher tried to make sure that the questionnaire was administered during the time of visits to each of the schools. Where it was not possible to administer the questionnaires face-to-face, the researcher requested the principal to assist with the distribution at a convenient time to ensure a high response rate of the questionnaires.

The questionnaire was structured using information gained from literature study regarding the topic to be investigated. The questionnaire had two sections: Unit A of the questionnaire was for the biographical data of participants while Unit B focused on the practical aspects and experiences of participants on the subject under investigation (White, 2005:255). Questionnaires and a covering letter explaining the purpose of the study, its relevance and instructions on how to complete the questionnaire were hand-delivered to the relevant participants by the interviewer. The interviewees were assured of the anonymity and confidentiality of their responses.

Mason and Bramble (1997:84) recommend that the researcher conducts a pilot study, which is a small-scale version of the proposed study but with a restricted number of participants. For this reason, the researcher handed out questionnaires to one of the selected schools which do not form part of the sample. This was done prior to distribution to the rest of the schools selected in Johannesburg. The feedback from the pilot study was used to rectify any unclear statements. The pilot study helped to fix any errors were on the questionnaires. This was important because it is not possible to modify items and questions that may not be clear to some respondents on the questionnaire once it has been distributed. Gall, Borg and Gall (1996:289) support the idea of having a pilot study before the actual study because it helps the researcher to make corrections to their questionnaire to enquire or examine deeply into respondents' opinions or feelings. Table 4.4 depicts the pilot sample that was used.

Table 4.4: Pilot study schools

Participants	**School 1**	**School 2**	**School 3**
Principals/deputy principal (interviews)	1	1	1
HoDs (interviews)	1	1	1
Teachers (interviews)	3	3	3
Learner Focus Groups (interviews)	1	1	1
Learners (questionnaires)	10	10	10
Teachers (questionnaires)	5	5	5

The researcher wrote a letter to the Gauteng Department of Education head office to seek permission to conduct the study in secondary schools in Soweto. Interviews were conducted in the second and third term in 2019. The researcher made sure not to disturb the normal functioning of schools.

4.8 DATA ANALYSIS AND INTERPRETATION

Data analysis is all about bringing order, structure and meaning to the gathered information. Although this is time-consuming, it is also creative and a fascinating process (Marshall & Rossman, 1995:111). Data analysis mainly involves synthesising of information collected by the researcher from different sources into one coherent description of what was observed or found (Fraenkel & Wallen, 2010:426). However, Punch and Oancea (2014:218) argue that among qualitative researchers the term "data analysis" has different meanings. These different interpretations lead to different analysis methods by researchers. Therefore, they further argue that there is a need to ensure that methods used for data analysis are systematic, disciplined and describable. Data analysis for this study was for both qualitative approach and quantitative approaches. Since the two types of data analysis were different, there was a need to clarify what was done in each approach and the following paragraphs will do that. However, the researcher planned to use the UNISA statistics expert to analyse the quantitative data so that there was more accuracy in the data analysis. The use of the UNISA statistics expert did not materialise; instead, the researcher used the SPSS to analyse the quantitative data.

4.8.1 Analysis of Qualitative Data

Data analysis in qualitative approach follows a series of steps. In this research, it was primarily an inductive process where data was organised into categories to identify patterns (relationships) among the categories. The researcher selected categorised, compared, synthesised and interpreted data in a systematic way. The analysis provided explanations of the single phenomenon of interest which was the research's main question (White, 2005:168-187).

Data analysis of qualitative data in this study was based on the content analysis of the interview transcripts. According to Leedy and Ormrod (2013:148), content analysis "is detailed and systematic examination of the content of a particular body of materials for the purpose of identifying patterns, themes and biases". Furthermore, Leedy and Ormrod (2013:148) reiterate that such materials as transcripts of conversations, legal documents and books, among others can be subjected to content analysis. One form of content analysis is thematic analysis. This form was used to analyse the interview transcripts for this study since it is a method of identifying, analysing and reporting patterns (themes) within data. The method helped in organising and describing the research dataset as well as interpreting various aspects of the research topic (Boyatzis, 1998:161). This is further defined as "a pattern in the information that at minimum describes and organises the possible observation and at maximum interprets aspects of the phenomenon" (Boyatzis, 1998:161). For this study, the researcher used the deductive thematic analysis method which involved developing initial codes and code categories from the research questions and theoretical framework or literature, reading interview transcripts and modifying the initial codes where necessary (Leedy & Ormrod, 2013:148). This was achieved through coding the qualitative data, collecting and interpreting codes and presenting data in a qualitative format.

When all the verbatim transcription had been done, the researcher read the transcript and modified the initial codes in the light of the data collected. When all this had been done, the coding of transcripts to identify, describe and capture the meaning in the texts followed. The codes and categories were then collated and themes were identified (Robson, 2011:476). Erlingsson and Brysiewicz (2017:94) viewed a category as content visible in the data with limited interpretation by the researcher. On the other hand, a code is usually a word or phrase that is assigned to a portion of a textual or visual data which clearly sums up and captures the essential content of the data (Saldaña, 2016:1). For Vaismoradi, Jones, Turunen and Snelgrove (2016:104), coding is a process of data reduction that condenses the amount of raw data to only that which is relevant to the research question. Furthermore, coding involves the breaking down of data to manageable components to examine them and make sense of data. Coding can be done manually or by a computer. The process of thematic analysis was facilitated using QDA Miner Versions 5.0.2.1., which is a Computer Assisted Qualitative Data Analysis Software (CAQDAS). The software has the capacity to store qualitative data. It also enables the researcher to code and collect the codes assigned to segments of qualitative data (LapPan, 2013).

Data obtained from the individual interviews was analysed through identification of common themes from the participants' description of their experiences. Information that was irrelevant was discarded. Information that was relevant was further broken into phrases or sentences which reflect a single, specific thought. Phrases and sentences which reflected various aspects of meanings were later used to develop an overall description as seen by the participants (McMillan & Schumacher, 2001:464). Since data analysis in the qualitative approach takes place simultaneously with data collection therefore it is important to manage the data properly. The management of data for this study was done through the following:

i. The researcher familiarised himself with the data and identified main themes in it through reading it several times.

ii. An in-depth examination of the data was carried out to provide detailed descriptions of the setting, participants and activities. The researcher described what he saw.

iii. The researcher categorised and coded pieces of data, physically grouping them into themes through classification. The researcher further broke down the data into smaller units, determining the importance of these units.

iv. The data was then interpreted, synthesised and organised to draw general conclusions or understandings.

4.8.2 Analysis of Quantitative Data

Quantitative data was analysed by means of SPSS. Educational research projects often make use of descriptive statistics to analyse quantitative data. Data generated from the questionnaires was analysed using descriptive statistics such as percentages, means, standard deviation and t-tests. Frequency counts and percentages were specifically used to answer Research Question 1, while the means and standard deviation were used to analyse the other research questions to ascertain whether there is a significant mean difference in the improvement of teaching and learning in Soweto secondary schools through the use of ICTs. The t-test is appropriate for identifying mean differences between two groups (Nworgu, 2015:7). For the analysis of quantitative data, the SPSS version 20 was used.

All the quantitative data were collected using the document checklist and analysed using frequencies and percentages to determine the percent of improvement in teaching and learning that is directly linked to the use of ICTs in Soweto secondary schools. In research quantitative analysis is about differentiating one thing from another by assigning numbers to things. Researchers use the numbers in different ways to investigate problems based on four properties of numbers. These four measurements scales include nominal, ordinal, interval and ratio (Vaismoradi et al., 2016:104).

The nominal scales (or category or classificatory) indicate only that there is a difference among categories. The analysis of data in the quantitative approach seeks to transform data into information, then into knowledge and finally to wisdom (Chenail, 2012:248). Therefore, this study categorised the emerged themes by selective coding. The data was analysed using the SPSS using statistical/numerical representations in the form of tables and other relevant numerical representations. The researcher also organised data collected into categories and sub-categories to compare and analyse the data and give it some meaning.

The ordinal scale was used as it assumes that variable of values can be rank-ordered from highest to lowest (Marshall & Rossman, 2010:33). An example of this type of measurement scale includes letter measures such as A, B, C, D or opinion measures such as strongly agree, agree, disagree and strongly disagree. The value of each value is thus related to others as being equal to, greater than or less than. There are also interval measurement scales which indicate everything that nominal scale and ordinal scales do not indicate. Interval measurements scales, however, further specify the distance between categories, for example Fahrenheit or Celsius temperature as 5°, 45°, 90° or IQ scores such as 95, 110, 125 IQ. Intervals scales provide researchers with a constant unit of measurement while giving meaning to the differences between numbers (White, 2005:168). However, ratio scales measurements are better as they present the most refined type of measurement. They include ordinal and interval scales. In addition, numbers on these scales can be compared meaningfully by saying it is twice or three times another number or half or quarter of a number. However, in education most measurements are not expressed as ratios since educators mostly think in terms of less or greater than and not in multiples (McMillan & Schumacher, 1997:204-206). Often the presentations of data using frequency polygons, frequency tables, pie charts, bar graphs and pictograms is done in social behavioral sciences (White, 2005:168).

Therefore, the researcher used the explanations above on data analysis and made use of the data to analyse quantitative data. The analysis was descriptive, and the researcher used mathematical techniques to organise, summarise and display a set of numerical data (Gall, Borg & Gall, 1996:757). The central tendency and variability measures were also used to describe the values in distributions (White, 2005:256). The data was ordered and summarised by means of tabulation and graphic representations. Data was summarised to create order among the inherent trends and properties (Steyn, 2000:2).

4.9 DATA TRUSTWORTHINESS

Leung (2015:324) argues that qualitative research, in many cases, has received criticism for its lack of quality and robustness. Researchers argue that its dimensions are blurred, while some claim that qualitative research falls short when it comes to trustworthiness (Sinkovics, Penz & Ghauri 2008:698). Researchers believe reliability and validity are fundamental when it comes to qualitative research.

The issue of trustworthiness is viewed and described differently by researchers. Cypress (2017:254) suggests that trustworthiness of a study is aligned to the extent to which readers have trust and confidence in the results. Trustworthiness of the study depends on how the reader of the research report judges and validates the results. Korstjens and Moser (2018:121) concur that trustworthiness is all about questions asked whether research findings can be trusted. for this purpose, Moon, Brewer, Januchowski-Hartley, Adams and Blackman (2016:17) propose that researchers need to provide adequate information on how their findings are credible, transparent, dependable and confirmable. Therefore, to achieve data trustworthiness, the researcher subjected the study to a pilot study.

Pilot studies are mostly small-scale preliminary studies done to determine if the key and crucial components of the study are covered (Cadete, 2017:1). Although pilot studies are commonly associated with quantitative research, its importance has now been expanded to qualitative research where it used in preparation for a major study (Majid, Othman, Mohamad, Lim & Yosuf, 2017: 1074). In qualitative research, pilot studies for interviews are an integral part or research since they help highlight the need for any improvisation to the interview guise before the main study is undertaken (Majid et al., 2017:1075). In this study, for the pilot study, preliminary interviews were done with two HoDs from each of the sampled schools. This was done to check the relevance of the research interview question to the study. The interviews were recorded, and a textual transcription was made soon after the session. Feedback from the HoDs and comments were used to make refinements to the interview questions. Sekhu (2019:44) concurs that prompt transcription of recorded interviews helps the researcher to note down observed body language and non-verbal cues when they are still fresh in the mind.

4.9.1 Credibility

The research is deemed credible when its findings are trustworthy and plausible. Stenfors, Kajamaa and Bennet (2020:598) argue that research can only be credible when the chosen methodology is well justified and explicated. Therefore, if the researcher wants to ensure that their research is credible, there is need to eliminate questions like "Was the study conducted using proper standard procedures for the qualitative approach with adequate justifications provided?" (Connelly, 2016:95). Therefore, for any research to be validated, it must have aspects of truth and value that are not questionable (Korstjens & Moser, 2018:122).

4.9.2 Validity and Reliability

Validity and reliability of data are fundamental requirements in both qualitative and quantitative research. This is important because maintaining validity and reliability in research enhances trustworthiness of the results (Mfuphi, 2020:64; Naidoo, 2015). The reliability of data in both qualitative and quantitative is concerned with the extent to which any measuring procedure employed repetitively produces the same results (Chisango, 2023:175). In qualitative research, validity is defined as a meticulous process carried out by the researcher to determine the preciseness and correctness of research results (Creswell, 2014:201). This is done by putting rigorous measures in place to test the trustworthiness of the research results (Mfuphi, 2020:64). On the other hand, Cohen, Manion and Morrison (2018:532) define validity in quantitative research as the extent to which a test measures what it is intended to measure, which is done by ensuring construct validity in a questionnaire. In this study, the researcher ensured that the analysis of data for both qualitative and quantitative were valid and reliable by pilot-testing the instruments before the actual study. The pilot study helped the researcher to change wording on the questionnaire and interview questions where necessary to avoid misunderstanding by participants. The data collection instruments were also evaluated by the supervisor of this study and the Research Ethics Committee at UNISA before they were used in the field.

4.9.3 Member Checking

Member checking is a data validation technique that is carried out to check credibility of the results (Birt, Cavers, Campell & Walters, 2016:1802). When doing member checking, the researcher asks participants to review all data collected by the interviewer while checking their interpretations thereof. Most participants generally appreciate this step because it offers them an opportunity to verify their own statements while affording them a chance to fill in the gaps that might arise from the interviews. Devault (2019) and Harper and Cole (2012:1) concur that member checking in research is crucial because it promotes trust. Hadi and Closs (2015:641) further reiterate that when participants check the study findings and conclusions during member checking, it helps ensure the credibility of the study. Therefore, when researchers want to improve the credibility of data collected and results, it is paramount for them to carry out member checking (Birt et al., 2016:1802). As a way of improving the credibility of the study, the researcher checked the results with some of the participants to check for accuracy and to confirm their answers.

4.9.4 Prolonged Engagement

Prolonged engagement is when the researcher spends time with the participants during interviews. The researcher does this by investing their time in the interview process to familiarise with the setting and context, to test and eradicate misinformation and to build trust with participants in order to collect rich data (Korstjens & Moser, 2018:122). Consequently, prolonged engagement assists the researcher to gain more insight into the context of the study and simultaneously helps them to minimise possible information distortions that may arise

(Anney, 2014:276). Prolonged engagements play a pivotal role in promoting credibility and quality of the study (Hadi & Closs, 2015:641). In an effort to create credibility in this study, the researcher explained to each participant how the findings of the study would be used. This was done to instil trust between the researcher and the participants (Korstjens & Moser, 2018:122).

4.9.5 Triangulation

Triangulation is a method or procedure used to validate data and increase the credibility of research findings in both qualitative and quantitative studies (Noble & Heale, 2019:67). This is done by combining data collection methods in research to ensure that fundamental biases that can arise in the use of one method are eliminated. Triangulation assists the researcher to explore and explain complex human behaviour by using of varied methods. The objective of using triangulation in research is to increase credibility and confidence in findings. Heale and Forbes (2013:98) concur that using a combination of findings from several rigorous methods provides a more comprehensive picture of the findings as opposed to the use of only one method. Therefore, triangulation is a powerful technique that helps with the validation of data through cross-verification from more than one source (Honorene, 2017:91). In this study, triangulation was carried out when the researcher used semi-structured interviews and questionnaires to collect data. The two data collection methods used complemented each other with the aim of doing justice to the main objective of the whole study.

4.9.6 Transferability

Transferability is referred to as the generalisability of findings (Nowell, Norris, White & Moules, 2017: 3). It seeks to generalise the findings of the study and apply them in other situations or contexts. Transferability is also concerned with the aspect of applicability (Korstjens & Moser, 2018:122). In transferability, it is the responsibility of the researcher to provide a detailed description of the research process and its participants. Devault (2019:231) argues that the provision of the detailed descriptions of the research process and participants is done to enable the reader to ascertain whether the findings of the research can also be applied or transferred to their own settings. Anney (2014:278) concurs that the detailed descriptions need to involve the researcher's research process which includes data collection context of the study and the production of the final report. Equipped with these detailed descriptions, researchers can replicate the study with similar conditions in other settings. The implication is that the reader and not the researcher will be the one to make the final judgement about transferability since the researcher will not know the reader's specific settings (Korstjens & Moser, 2018:122). However, the researcher must make sure that the detailed descriptions include sufficient details about settings, sample characteristics, inclusion and exclusion criteria and data collection and analysis methods (Hadi & Closs, 2015:641). This is very important to assist the reader to evaluate the extent to which the conditions explained by the researcher are transferable to other settings.

In traceability, the researcher's responsibility to provide readers with detailed descriptions so that the readers can make inferences about transferring the same findings in other settings (Polit & Beck, 2010:1453). To ensure transferability of the research findings of this study, information for this study was detailed in the study. This will help the reader make a decision regarding the transferability of the research findings to other settings.

4.9.7 Dependability

Findings of any research must be dependable and reputable if the study is done again with the same cohort of participants, codes and context (Feroro, Nahidi, Costa, Mohsin, Fitzgerald, Gibson, McCarthy & Aboagye-Sefo, 2018:3). Dependability of study findings, according to Choudhury (2015:150), is referred to as the employment of overlapping methods and in-depth methodological descriptions that allow the same study to be repeated in different settings. Korstjens and Moser (2018:122) are of the view that there is a need for consistency if a study is to be dependable. They further emphasise that researchers have an obligation to thoroughly check whether the data analysis process of any research was done in line with acceptable standards of that design. However, Devault (2019:231) argues that most qualitative researchers believe that it not necessary to demonstrate dependability if credibility has already been demonstrated. On the contrary, Lemon and Hayes (2020; 605) proclaim that dependability substitutes reliability and that findings are confined to a specific time and place provided there is consistency of explanations across all data.

4.9.8 Confirmability

The extent to which results from research can be confirmed or corroborated by other researchers is referred to as confirmability (Trochim, 2019:2). Confirmability ensures that findings are as far as possible results of the experiences and ideas of participants rather than the preferences of the researcher (Pandey & Patnaik, 2014:5751). Therefore, to improve confirmability of the study, it is the responsibility of the researcher to make sure that personal bias does not creep into the study findings. Hadi and Closs (2015:641) recommend creating an audit trail. The audit trail must be a detailed description of sources, techniques of data collection and analysis methods, interpretations made, decisions taken and influences of the researcher. All this is done with the aim to demonstrate the truthfulness of the research findings. The researcher ensured the confirmability of the study by audio recording and transcribing all interviews. Hard and electronic copies have been kept safe for future reference.

4.10 RESEARCH ETHICS

The focus of ethical measures is on specific contexts of planning conducting, communication and research follow-up which the researcher should commit to (Punch & Oancea, 2014:59; Schulze, 2002:17). In essence, research ethics are rules and guidelines established to define the researcher's conduct. Parveen and Shawkat (2017:2) assert that the moral principles that govern a person's behaviour are called ethics. In research, ethics are norms of conduct helping the researcher to distinguish between right and wrong and between what is acceptable and not acceptable. This is necessary when qualitative research is used, especially research in educational contexts that involve human subjects where some participants may be under the age or majority (Dooly, Moore & Vallejo, 2017:351). This means it is the researcher's responsibility to make sure that all aspects relating to safety, dignity, rights and wellbeing of the participants have been taken into consideration. For this reason, this study was grounded in the framework of research ethics. The following ethical principles were adhered to by the researcher:

4.10.1 Permission to Conduct Research

Research that involves humans as participants must first be approved by the Research Ethic Committee (REC) before data collection commencement (Fleming & Zegwaard, 2015:210). According to Creswell (2014:41), before embarking on a research study, the researcher should seek permission from the ethics board of the university, participants and employees governing authorities. In this study the researcher sought approval for conducting research from the Research Ethics Committee at the UNISA before any data was collected (Appendix A). The researcher also wrote a letter to the Gauteng Department of Education head office seeking permission to conduct the study in schools in Johannesburg (Appendix B, C and D). The researcher further sought permission from the targeted institutions before data was collected (Appendix E and F).

4.10.2 Informed Consent

Before carrying out any research it is an obligation for the researcher to first obtain informed consent from the participants (Fleming & Zegwaard, 2015:210). Participants have the right to be fully informed of what will be asked of them, what collected data will be used for and any possible consequences, if any. The informed consent process is like a contract between the researcher and participants (Fleming & Zegwaard, 2015:210). This procedure is very important because participants should be informed about their rights and that their participation in any research need to participate voluntarily in the research (Manti & Licari, 2018:145). Participants in this study were given adequate information pertaining to the study before data collection (Schulze, 2002:17) (Appendix G). The researcher explained to all the participants the aims of the research, the procedures to be followed, possible advantages and disadvantages for the participants and how the results will be used. This was necessary since informed consent is an ethical and legal requirement for any research that involves humans (Nijhawan, Janodia & Musmade, 2013:1). Furthermore, the informed consent protects participants from possible risk or harm while simultaneously equipping them with appropriate information that they need to make informed decision about their participation in the research (Nussbaum, Douglas, Damus, Paasche-Orlow & Estrella-Luna, 2017:2). However, Ochieng (2012:18) is of the view that many times the process of informed consent is abused to the researcher's advantage while exploiting or possibly harming participants. Therefore, consent is not just a mere signature but an information-exchange process between researcher and participant.

Given what has been said above, all participants that were involved in this study were given informed consent forms. They carefully went through the consent forms before taking part in the research. The researcher asked participants if they needed any clarification on the information on the consent forms. Once the participants were satisfied with all envisaged in the consent forms and how the researcher addressed their concerns, they were asked to sign the consent forms and the interviews commenced thereafter (Appendix H). The original consent forms were retained by the researcher for filing.

4.10.3 Confidentiality and Anonymity

A researcher should always be responsible, vigilant, mindful and sensitive to human dignity (Gay, 1996:85). It is the responsibility of the researcher to make sure that participants information is kept confidential and that assurances in protecting their names are also extended (Fleming & Zegwaard, 2015:211). This is important in any research because confidentiality and anonymity are ethical practices applied to protect participants during data collection, data analysis and the reporting of the research findings. Coffelt (2017:228) described confidentiality as the separation and modification of participants' personal information when collecting data. Wiles, Crow, Heath and Charles (2008:2) agree that anonymity and confidentiality is central to ethical practice to protect participants' information. In this study, participants' confidential information was not compromised at any time, as their names and the names of the schools were not used in the collection of data. No private or secret information was divulged, as the right to confidentiality of the participants was respected (Coffelt, 2017:228). Participants were assured before data collection that every effort would be made to ensure that the data they provided would not be divulged to anyone. Therefore, the researcher together with the thesis supervisor were the only people who had access to the data. The responses of participants remained anonymous to ensure that the confidentiality of the participants was maintained.

4.10.4 Dissemination of the Research Findings

When the research is completed, participants will be informed on the findings of the study as gesture of goodwill by the researcher to show gratitude to the participants (Schulze, 2002:19). Schools may be provided with a summary of the findings including recommendations thereof in the form of notes or short presentations.

4.11 CHAPTER SUMMARY

This chapter outlined the research and methodology used in the study. The chapter also outlined and justified why the mixed method design was used for this research. Data collection instruments for the study were also explained which included questionnaires and interview schedules. The chapter also explained the data management process, which among other things includes the capturing, reduction, cleaning and organisation of the data into patterns. Another important aspect of the chapter was the discussion on how data analysis was carried out. Again, issues of validity and reliability with regard to the use of research instruments were also highlighted. The chapter further discussed ethical considerations that had to be observed in the study for the protection of the participants' privacy and confidentiality. In the next chapter, the analysis and interpretations of the data is provided.

CHAPTER 5

DATA ANALYSIS, PRESENTATION AND DISCUSSIONS

5.1 INTRODUCTION

The previous chapter discussed the research design and research methodology. This chapter presents the findings, analysis and interpretation of quantitative data from both learners and teachers and qualitative data from the teachers' interviews. The data were carefully presented to protect the identity of the participants and their schools (Mekonnen, Workie, Yimer & Mersha, 2017:130). The data shed light on ICT use in the schools and their contribution to learner and teacher performance. The chapter focuses on the response rate of both learners and teachers and points out the limitations that were experienced during the data collection process. The aim of this study was to evaluate how the effective use of ICTs can improve learner and teacher performance in Soweto secondary schools. The objectives of the study were to establish how ICTs were used in participating schools, and simultaneously, identify problems associated with the use of ICTs. Another objective was to determine the challenges faced by learners and teachers in the use of ICTs in these schools, to probe the current practices and to propose recommendations that could lead to effective use of ICTs and improve learner and teacher performance in Soweto secondary schools.

5.2 RESPONSE RATES

The study purposively targeted five secondary schools in Soweto. Johnson and Wislar (2012:1805) argue that a higher response rate produces findings that are more representative and can be generalised to the population of interest. However, this is not scientifically proven; hence, the researcher ensured that the sample was large enough to enable him to make inferences about the population (Terre Blanche, Durrheim & Painter, 2006:49). In this study, the researcher was satisfied with the data collected because it was a reasonably large sample intended to accommodate possible shortcomings and non-response from some participants as indicated in Table 5.1.

Table 5.1: Response rates

Sample	Sample size	Responses	% Response rate
Learners (Quantitative)	100	85	85.0
Educators (Quantitative)	50	46	92.0
Principal/deputy (Qualitative)	5	5	100
HoDs (Qualitative)	5	5	100
Educators (Qualitative)	15	15	100

Table 5.1 indicates the response rates after more than four months of data collection. The initial intended time that was sufficient for data collection was two months. However, the time had to be extended because of the unexpected COVID-19 pandemic that hit South Africa and the entire world that forced the government to close schools. The closure of schools made it difficult for the researcher to collect data as planned. The government had to impose considerable measures to contain the spread of the virus which included, among other things, prohibiting people from gathering in big numbers, movement restrictions on people, social distancing and many other measures. This meant that the dynamics of data collection for the researcher changed, and more time was needed.

Moreover, schools were no longer freely allowing visitors without following due processes to safeguard learners, educators and other school staff at the school. Accordingly, the researcher needed to make sure that all proper safety measures were put in place before going to collect data at any school. This extended the time the researcher needed for data collection. Despite these challenges, a significant number of questionnaires were collected, and the researcher managed to conduct all the intended interviews. The outstanding questionnaires could not be collected due to COVID-19 restrictions. Nevertheless, the researcher was satisfied with the retuned questionnaires from all five schools as they provided comprehensive and rich data that was useful for the study.

Johnson and Wislar (2012:1805) argue that a response rate can be used as a standard to produce findings that are representative and can be generalised to the population of interest, especially when there is a high response rate. Therefore, the researcher believed that the representativeness of the sample could give accurate findings and that sample size would not matter unduly. This is in line with Abbot and McKinney's (2013:118) assertion that the sample can be small and still valid. The main point here is that validity can be ensured if the findings from the collected questionnaires provide rich information and there is consistency in the responses from all the participants. Therefore, one can conclude that the collection of more questionnaires would not add value to the research but the validity of the results could be ensured by other means.

5.3 NAME OF SCHOOLS AND NUMBER OF PARTICIPANTS PER SCHOOL

1. School A
2. School B
3. School C
4. School D
5. School E

The number of all the learners who participated from each school is tabulated in Table 5.2.

Table 5.2: Name of school and number of participants per school

Name of School	Frequency	Percent	Valid%	Cumulative%
School A	19	22.4	22.4	22.4
School B	14	16.5	16.5	38.8
School C	18	20.0	20.0	58.8
School D	15	17.6	17.6	76.5
School E	19	23.5	23.5	100.0
Total	85	100.0	100.0	

5.4 QUANTITATIVE DATA ANALYSIS

The research sample comprised five secondary schools in Soweto. The intention was to administer the questionnaires to 20 learners per school. The researcher managed to go to all the following five schools that were selected for this study: The data collected from the learners and educators' questionnaires from the five secondary schools was summarised, cleaned and prepared by using Microsoft Excel to get it ready for compiling descriptive statistics through the SPSS version 23. The SPSS version 23 was used to analyse and calculate frequencies, percentages and level of significance, compare data and draw graphs to represent different sets of data. Determining frequencies was very important in determining key responses and relationships between variables such as gender, grades, subjects, skills, competences and awareness of both learners and educators in the use of ICTs in schools. Data was summarised and presented on bar graphs, pie-charts, graphs, tables and figures for easy interpretation. The questionnaires with two or more questions unanswered were excluded from the data. In total, 88 questionnaires were received from learners and three were excluded because only one or two questions were answered meaning that only 85 questionnaires from learners were used for this study. On the other hand, all 47 questionnaires received from educators were used for the study.

5.5.1 Quantitative Data Analysis – Learners

5.5.1.1 Demographic details of learners

Saunders, Lewis and Thornhill (2012) as cited in Nyathi (2022:54) asserts that the analysis of participants' demographic data is crucial since it ensures that key demographic attributes of participants are scrutinised. In this study, all the learners were in the further education training (FET) band, mainly Grade 11 learners and very few Grade 10 and 12 learners. Most of them had been revealed to or used ICTs at their schools. Hence, they were regarded as knowledgeable on information sought for this study. The intention was to get an equal gender representation and the researcher tried his best to achieve that although this was difficult to achieve due to the voluntary nature of participation in the study. Ultimately, the researcher had to work with only those participants who were interested to be part of the study. The learners' different subject choices are included in Table 5.3, to ascertain the number of learners currently taking ICT-related subjects in Soweto secondary schools. This is very important because the major aim of this study was to investigate how effective use of ICTs can improve learner and teacher performance in South African secondary schools.

Even though South Africa has made considerable progress in the use of ICTs, many township schools are still lagging in many aspects in education provision including effective and efficient use of ICTs to promote learner and teacher performance. Considering that ICTs have become an integral part of the education system, especially in the twenty-first century, the focus should be on finding out how many learners are currently embracing ICT-related subjects in their schools. Therefore, the inclusion of subject choices for learners in this study is critical. Table 5.3 shows the different subjects that all the participants were taking in their respective schools. This could help the researcher to establish how many learners were taking ICT-related subjects and how the effectiveness of these ICTs in improving learners' performance in the respective Soweto secondary schools and nationally.

Table 5.3: Demographic representations of learners

	School A		**School B**		**School C**		**School D**		**School E**		**Total Sample**	
	n	%	n	%	n	%	n	%	n	%	n	%
Gender												
Male	13	68.42	5	35.71	8	44.44	5	33.33	10	52.63	41	48.24
Female	6	31.58	9	64.29	10	55.56	10	66.67	9	47.37	44	51.76
Total	19	100	14	100	18	100	15	100	19	100	85	100
Grade												
10	0	0	0	0	14	77.78	1	6.67	0	0	15	17.65
11	19	100	14	100			14	93.33	8	42.11	55	64.70
12					4	22.22			11	57.89	15	17.65
Total	19	100	14	100	18	100	15	100	19	100	85	100
Subjects												
English	19	100	14	100	18	100	15	100	19	100	85	100
Setswana	3	15.79	5	35.71	8	44.44	3	20	12	63.16	85	36.48
Sesotho	3	15.79	4	28.57	6	33.33	2	13.33	6	31.58	85	25.71
Xitsonga	0	0	0	0	0	0	1	6.67	0	0	85	1.18
Sipedi	0	0	0	0	0	0	0	0	1	5.26	85	1.18
Isizulu	11	57.89	5	35.71	4	22.22	9	60	0	0	85	34.12
Pure Maths	7	36.84	7	50	14	77.78	15	100	2	10.53	85	41.18
Maths Literacy	12	63.16	7	50	2	11.11			14	73.68	85	41.18
Geography	10	52.60	10	71.40	1	7.10			5	26.30	85	30.59
Life Orientation	19	100	14	100	18	100	15	100	19	100	85	100
Business Studies	0	0	4	28.57	2	11.11	0	0	11	57.89	85	20
Accounting	0	0	3	21.43	1	5.56	0	0	0	0	85	4.71
Tourism					1	5.56			19	100	85	23.53
Physical Sciences	7	36.84	6	42.86	14	77.78	15	100	0	0	85	49.41
Life Sciences	8	41.11	2	14.29	13	72.20	15	100	0	0	85	44.71
Economics			3	21.43	1	5.56					85	4.71
History	12	63.16	5	35.71	1	5.56			14	73.68	85	37.64
Computer application technologies	19	100	7	50	15	83.33	14	93.33	16	84.21	85	83.53
Technical Mathematics	0	0	0	0	2	11.11	0	0	0	0	85	2.35
Civil Technology (Construction)	0	0	0	0	1	5.56	0	0	0	0	85	1.18
Technical Sciences	0	0	0	0	1	5.56	0	0	0	0	0	1.18

The following observations were noted in the five schools that took part in the study as depicted in Table 5.3. Although not all targeted learners from each school participated in the study, a reasonable number participated. All in all, 85% (n=85) learners took part in the study from the intended 100 learners. From each school the intended number of participants was 20 learners. The following is a breakdown of the total number of learners who took part in the study from each school:

School A – (n=19) learners
School B – (n=14) learners
School C – (n=18) learners
School D – (n=15) learners
School E – (n=19) learners
Total – (n=85) learners

Furthermore, it can be seen in Table 5.3 that 48.20% (n = 41) of the participants were male while 51.80% (n=44) were females. Thus, there were more females' respondents than males. The table also revealed that School A and E had the most participants (n=19) each, while school B and D had the least (n=14) and (n=15) respectively.

Table 5.3 revealed that most participants were in Grade 11 and counted for about 64.70 (n=55)% of the total sample of 85 participants. Grade 10 and Grade 12 both contributed 17. 65% each (n=15) each. Initially, the study targeted Grade 11 learners only to avoid disturbing Grade 12 learners who were focusing on their final year examinations. However, because of the unanticipated and unprecedented problem of the COVID-19 pandemic that forced the closure of schools, the researcher had to accept a few learners from other grades in some schools to take part in the study. Moreover, learners attended schools on a rotational basis on designated days and different grades were phased in gradually. Not all learners were willing to take part in the study because of fear of COVID-19 infection. The researcher had to work with learners in the FET phase who were willing to take part in the study. This explains why Grades 10 and 12 learners participated in the study. Nonetheless, the researcher managed to collect data from all the participants who participated in the study.

The table also reveals that Pure Mathematics, Mathematics Literacy, Physical Sciences, Life Sciences and Computer Application Technology were the subjects with the most enrolment in the five schools. About 41.18% (n=45) of the participants did Pure Mathematics, 41.18% (n=45) did Mathematics Literacy, 49.41% (n=42) did Physical Sciences, 44.71% (n=38) did Life Sciences and 83.53% (n=71) did Computer Application Technology (CAT). However, some schools had more learners doing certain subjects than others. For example, School C and D had more learners doing Pure Mathematics than others. School C had (n=14) and School D had (n=15) learners doing Pure Mathematics. Again, Schools C and D had more learners doing Mathematics Literacy than A, B and E. School C had (n=12) and School D had (n=14) learners doing Mathematics Literacy. Furthermore, School C and D had more learners doing Physical Sciences than A, B and E. School C had (n=14) and School D had (n=15) learners doing Physical Sciences. School A and E had more learners doing CAT. School A had (n=19) and School E had (n=16) learners doing CAT. School C and D also have more learners doing Life Sciences, where School C had (n=13) and School D had (n=15) learners for Life Sciences respectively. When focusing on the number of learners taking up computer application technology as a subject in the five schools, it was encouraging that 83.53% (n=71) of learners took CAT as a subject. This shows that learners were aware of the importance of being competent in ICTs in the twenty-first century. For CAT to have the second highest number of learners after compulsory subjects is a positive pointer. This shows that more learners embraced ICT-related subjects. This was in line with the focus of this study which sought to establish how effective use of ICTs in Soweto secondary schools promoted teacher and learner performance. The fact that more learners are doing CAT gives hope that they embrace the benefits that come with ICT and may use them to improve their performance.

5.5.2 Learners' Responses to Questionnaire Questions

5.5.2.1 Learners' responses on having an ICT laboratory/centre

The first question sought to establish if each school had at least a computer laboratory or centre as expected. The question sought to determine if Soweto secondary schools were ICT-complaints. Table 5.4 shows the learners' responses to this question.

Table 5.4: Frequency distribution of learners' responses on having an ICT laboratory/centre at the school

Question	**School A**		**School B**		**School C**		**School D**		**School E**		**Total Sample**	
Do you have an ICT Laboratory/centre	n	%	n	%	n	%	n	%	n	%	n	%
Yes	16	84.2	13	92.9	15	83.3	14	93.3	19	100	77	90.6
No	3	15.8	1	7.1	3	16.7	1	6.7	0	0	8	9.4
Total	19	100	14	100	18	100	15	100	19	100	85	100

The data projected in Table 5.4 shows that in School A, 84.2% (n=16) said they had an ICT centre while 15.8% (n=3) said they did not have. In School B, 92.9% of learners indicated they had a computer centre with only 7.1% (n=1) indicating they did not have one. In School C, 83.3% (n=15) learners pointing out they had an ICT centre while 16.7% (n=3) pointed out they did not have an ICT centre. In School D, 93.3% (n=14) agreed they had an ICT centre while 6.7% (n=1) said they did not. Lastly in School E, a 100% (n=19) of the learners indicated they had an ICT centre. School E is the only school where all learners said the same thing. Overall, 90.6% (n=77) learners from the total sample responded positively that their schools had computer laboratories/centres, while 9.4% (n=8) said they did not. The latter response could have been due to a lack of knowledge or misunderstanding the question.

However, the findings presented in Table 5.4 indicate that all the schools had computer laboratories. This is positive and encouraging and in line with Ballew, Omoto and Winter's (2015:10620) that the availability of ICTs in schools is important as it offers learners and teachers new opportunities and promotes knowledge acquisition. By contrast, Mdlongwa (2012:5) claimed that not enough computers are available for education in South Africa due to limited resources and high costs in procuring computer-related accessories. Cleary, this study shows that since the findings of Mdlongwa (2012), South Africa has made significant strides to integrate ICTs in schools.

The findings in Table 5.5 show that learners School A had (n=30), computers, School B (n=15), School C (n=10), School D (n=27) while School E had (n=30) computers.

Table 5.5: Learners responses on the number of computers

Number of computers in the computer laboratory/centre	**School A**		**School B**		**School C**		**School D**		**School E**		**Total**	
	n	%	n	%	n	%	n	%	n	%	n	%
	30	26.8	15	13.4	10	8.9	27	24.1	30	26.8	112	100

Although some of the learners were not sure of the exact numbers of computers, the researcher managed to establish the exact number from each school. It is evident from the data collected that some schools had more computers than others. Schools A, D and E had the greatest number of computers while Schools B and C had the least. Despite the difference in the number of computers in different schools, it is pleasing to know that all five schools had a sizeable number of computers. However, the government still needs to do more to make sure that there is equitable distribution of computers in all South African schools. Ismail, Jogezai and Baloch

(2020:1537) confirmed that while wealthy countries have made significant advances in the use of ICTs in teaching and learning, many schools in developing countries such as South Africa still need to do more in that regard.

5.5.2.2 Learners responses' regarding the use of computers in the last six months for Microsoft Word, learning and doing research

The second question asked learner respondents if they had used computers for Microsoft Word, learning and doing research in the last six months. Out of 85 learners, 94% (n=80) responded while 5.9% (n=5) did not. A summary of their responses covering the three aspects is tabulated in Table 5.6.

Table 5.6: Learners' responses to whether they had used computers for Microsoft Word in learning or doing research in the last six months

	YES		NO		Total	
Question	**n**	**%**	**n**	**%**	**n**	**%**
Have you ever used computers for doing homework in the last 6 months?						
School A	12	63.2	7	36.8	19	100
School B	6	42.9	8	57.1	14	100
School C	8	44.4	10	55.6	18	100
School D	5	33.3	10	66.7	15	100
School E	19	100	0	0	19	100
Total	50	58.8	35	41.2	85	100
Have you ever used computers for learning in class in the last 6 months?						
School A	18	100	0	0	18	100
School B	10	71.4	4	28.6	14	100
School C	9	50	9	50	18	100
School D	15	100	0	0	15	100
School E	19	100	0	0	19	100
Total	71	83.5	14	16.5	85	100
Have you ever used computers for doing research in the last 6 months?						
School A	16	84.2	3	15.8	19	100
School B	9	64.3	5	35.7	14	100
School C	8	44.4	10	55.6	18	100
School D	7	46.7	8	53.3	15	100
School E	19	100	0	0	19	100
Total	59	69.4	26	30.6	85	100

As Table 5.6 shows, three sub-questions were asked. The first sub-question wanted to establish the number of learners who had used computers for doing homework in the last six months.

The table indicates that 58.8% (n=50) of the total respondents agreed that they have used computers for homework in the last 6 months while 41.2% (n=35) said they did not. The table further revealed the number of learners who had used computers in the last six months differed per school. School E had the highest number of learners who admitted to using computers for homework in the last six months. The school had 100% (n=19) followed by School A with 63.2% (n=12) while School B had 42.9% (n=6), School C 44.4% (n=8) and School D 33.3% (n=5).

The second sub-question sought to establish the number of learners who had used computers for learning in the class and 83.5% (n=71) said yes while only 16.5% (n=14) said no. Again, the responses from all five schools differed. Schools A, D and E had the highest number of learners who indicated they had used computers for learning in class in the past six months. They recorded 100% while Schools B and C had the lowest. School B had 71.4% (n=10) while School C had 50% (n=9).

The information from the table also gives participants' responses on whether they had used computers for research purposes in the last six months. This is in line with the third sub-question. According to the data in Table 5.6 69.4% (n=59) confirmed they had used computers in the past six months for research purposes while 30.6% (n=26) said they did not. School E once again had the highest number of learners saying they used the computers for research purposes in the last six months with 100% (n=19) learners confirming. School E was followed by School A with 84.2% (n=16), then School B 64.3% (n=9), followed by School C with 44.4% (n=8) and School D with 46.7% (n=7).

Interestingly, more than 50% of the learners answered 'Yes' to all three aspects of the question, which indicates that schools were increasingly encouraging learners to use computers for schoolwork-related matters. Some 90% (n=72) learners agreed that they had used computers for learning in the last six months. This shows that secondary schools in Soweto making big strides in the use of ICTs in the teaching and learning. This in line with an assertion by Arends (2021:134) that the use of ICTs in the classroom enhances the learners to learn. However, the data in Table 5.6 does not indicate whether the use of computers in these schools was effective and improved learner performance. Moreover, 70% (n=56) learners said they had used computers for research purpose in the last six months, particularly in education-related matters.

5.5.2.3 Learners' responses to whether their teachers used microsoft word, powerpoint, smart notebook or other tools for teaching, learning and lesson planning

Table 5.7: Computer programmes used by teachers for teaching, learning and lesson plans

	YES		NO		Total	
Question	**n**	**%**	**n**	**%**	**n**	**%**
Does your teacher use Microsoft Word for teaching and learning?	78	91.8	7	8.2	85	100
Does your teacher use PowerPoint for teaching and learning?	58	68.2	27	31.8	85	100
Does your teacher use Excel for teaching and learning?	42	49.4	43	50.6	85	100
Does your teacher use Smart Notebook for teaching and learning?	38	44.7	47	55.3	85	100
Does your teacher use other for teaching and learning?	20	23.5	65	76.5	85	100
Does your teacher use PowerPoint for lesson preparation?	16	18.8	69	81.2	85	100
Does your teacher use Excel for lesson preparation?	13	15.3	72	84.7	85	100
Does your teacher use Smart Notebook for lesson preparation?	10	11.8	75	88.2	85	100
Does your teacher use other for lesson preparation?	8	9.4	77	90.6	85	100
Does your teacher use Microsoft Word for lesson preparation?	14	16.5	71	83.5	85	100

Out of 85 learners who responded to this question as depicted in Table 5.7, 918% (n=78) said their teachers used Microsoft Word for teaching and learning, while 68.2% (n=58) indicated that their teachers used PowerPoint for teaching and learning. These two figures are significant as they show that teachers use technology meaningfully in teaching, which optimises student learning. Some 49.4% (n=42) learner respondents agreed that their teachers used Excel for teaching and learning, while 44.7% (n=38) reported that they used smart notebooks for the same purpose. Although the number is slightly below half, it is still significant that many teachers are reported to be using smart notebooks given the socioeconomic disadvantage of

Soweto secondary schools. Furthermore, the findings revealed that 23.5% (n=20) learners stated that their teachers used technological gadgets and apps for teaching and learning purposes. However, it is worrying because these teachers were not using familiar ICTs that other teachers were using.

Regarding lesson preparation, 18.8% (n=16) learners reported that their teachers used Word program for lesson planning. This is worrying because this number is very low. Therefore, one cannot say with certainty if it was due to a shortage of computers or a lack of Microsoft Word skills on the part of teachers. Some 18.8% (n=16) learner respondents said their teachers used PowerPoint for lesson preparation purposes, which is worrying because the number is very low. Moreover, 15.3% (n=13) learners indicated that their teachers used Excel for lesson preparation, which is also very low. On the other hand, 11.8% (n=10) learners revealed that their teachers used smart notebooks for lesson preparation, which is very low and not encouraging. Some 9.4% (n=8) learners reported that their teachers used other ICTs for lesson preparation.

The findings from the study were worrying because it is not known with any certainty what these teachers were using. Overall, the data from learners show that, generally, not many teachers used ICTs for lesson preparation. One of the contributions could be that teachers did not have support and training on the use of ICTs for teaching and learning in the classroom. Comi, Argentin, Gui, Origo and Pagani (2017:24) stress that it is crucial for teachers to receive support in using ICTs for teaching and learning for technology implementation to have an impact in the classroom. Arends (2021:63) concurs that teacher development and support in the use of ICTs for teaching and learning is vital to boost teacher confidence and produce positive results.

5.5.2.4 Learners' level of confidence in using computers and other ICT instruments

The question aimed to probe learners' level of confidence in using computers and other ICT instruments. All 85 learners responded to the question.

Table 5.8: Analysis of learners' level of confidence in using a computer and other ICT instruments

Learner confidence with computers and other ICT instruments		School A		School B		School C		School D		School E		Total sample	
		n	%	n	%	n	%	n	%	n	%	n	%
Responses	Confident	9	47.4	8	57.1	10	55.5	5	33.4	9	42.4	85	48.3
	Fairly confident	4	21.1	2	14.3	3	16.7	2	13.3	0	0.0	85	12.9
	Very confident	4	21.0	4	28.6	2	11.1	2	13.3	0	0.0	85	14.1
	Not confident	2	10.5	0	0.0	3	16.7	6	40.0	10	57.6	85	24.7
	Total	19	100	14	100	18	100	15	100	19	100	85	100

The results in Table 5.8 show that in School A 47.4% (n=9) learners said they were confident in using computers and other ICTs, 21.1% (n=4) indicated that they were fairly confident, 21.0% (n=4) were very confident and only 10.0% (n=2) were not confident. In School B 57.1% (n=8) indicated they were confident in using computers and other ICTs, 14.3% (n=2) were fairly confident while 28.6% (n=4) indicated they were very confident. However, 16.7 (n=3)% in this school pointed out that they were not confident at all. School C had (n=10) 55.5% learners who are confident in using computers and other ICTs, 16.7% (n=3) fairly confident with 11.1% (n=2) while 16.7% (n=3) indicated that they were not confident. In School D, 33.4% (n=5) were confident with computers and other ICTs, 13.3% (n=2) were fairly confident, another 13.3% (n=2) said they were very confident, but 40% (n=6) indicated they were not confident at all. In School E, 42.4% (n=9) learners stated they were confident while 57.6% (n=10) learners indicated they were not confident. Overall Schools A, B and C had the highest number of confident learners when using computers and other ICTs. Schools D and E had the least confident learners. The highest number of very confident learners was found in schools A and B. School E did not have a single learner that pointed out that they were very confident in the use of computers and other ICTs. Looking at the total sample of 85 learners, 48.3% (n=41) were confident in using computers, 12.9% (n=11) were fairly confident and 14.1% were very confident. However, 24.7% (n=21) stated they were not confident in the use of computers and other ICT instruments. The low number of learners who were confident in using ICTs in this study may have been exacerbated by their lack of computer skills. Masha (2021:606) agrees that the lack of learners' skills is one of the contributory factors to learners' lack of confidence in using ICTs in the classroom.

5.5.2.5 Learners' skills to use computers and other ICT instruments

The fifth question asked learners whether they had the necessary skills to use computers and other ICT instruments. This was crucial because the study sought to establish whether teachers and learners' performance could be enhanced through effective use of ICTs in Soweto secondary schools.

Table 5.9: Learners' responses on having necessary computer skills and other ICT instruments

Question			**Frequency**	**Percent**	**Total Sample**	**Percent**
Do you feel you have the necessary computer skills?	School A	No	4	21.1	19	100
		Yes	15	78.9	19	100
		Total	19	100	19	100
	School B	No	4	28.6	14	100
		Yes	10	71.4	14	100
		Total	14	100	14	100
	School C	No	2	11.1	18	100
		Yes	16	88.9	18	100
		Total	18	100	18	100
	School D	No	0	0	15	100
		Yes	15	100	15	100
		Total	15	100	15	100
	School E	No	0	0	19	100
		Yes	19	100	19	100
		Total	19	100	19	100

Table 5.9 shows that in all five schools, a substantial number of learners indicated they had the necessary computer skills. School A had 78.9% (N=15) learners who said they had the computer skills, School B had 71.4% (N=10), School C 88.9% (N=16), while Schools D and E had 100% respectively. Overall, 89.4% (N=76) learners agreed that they had the necessary skills to use computers and other ICT instruments, while 10.6% (N=9) said that they did not. A conclusion can be drawn that the awareness and computer levels in all five schools were

relatively high. However, what is not known is whether this awareness warrants effective use of ICTs in these skills. The results in Table 5.9 differ from the researcher’s observation in the previous findings displayed in Table 5.8. From the researcher’s observation, the learners’ low confidence in using ICTs can be attributed to a lack of skills. However, the results in Table 5.9 show that a significant number of learners from each school indicated that they had computer skills. Shava (2021: 81) argues that when learners are revealed to proper ICTs, they can demonstrate their ICT skills in finding information for different topics. This could have been the case with the learners from the five schools in this study.

5.5.2.6 Learners’ responses on why they lacked computer skills

Table 5.10: Reasons for not having computer skills

Learner confidence with computers and other ICT instruments		**School A**		**School B**		**School C**		**School D**		**School E**		**Total sample**	
		n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Responses	No training	4	21.1	2	14.3	2	11.1	0	0.0	0	0.0	85	9.4
	No access to the internet	1	5.3	1	7.1	0	0.0	0	0.0	0	0.0	85	2.4
	Don’t have a computer	0	0.0	0	0.0	0.0	0.0	0	0.0	0	0.0	85	0.0
	N/A	14	73.6	11	78.6	16	88.9	15	100	19	100	85	88.2
	Total	19	100	14	100	18	100	15	100	19	100	85	100

According to Table 5.10, 21.1% (n=8) learners indicated that they their reason for not having skills was due to lack of training. The 21.1% (n=8) was from only three schools where (n=4) were from School A (n=2) for School B while another (n=2) was from School C. Only one learner from two other schools stated that the reason for not have computer skills was due to the lack of internet access. However, 73.6% (N=14) learners in School A indicated that they had skills, 78.6% (n=11) in School B also said they had computer skills, in School C, 88.6% (n=16) had skills, while School D and E respectively had 100% learners claiming to have computer skills. Therefore, from the total sample of 85 learners, 11.8% (n=10) learners pointed out they had no computer skills while 88.2% (n=74) learners indicated they had the skills. Having a high number of learners with computer skills was encouraging. This could imply that more learners in the schools under study were revealed to computers and training thereof. This is not surprising because Selwyn et al. (2020:73) alluded to the fact that long before COVID-19, leading researchers had already started advocating technology education. Although this study was carried out during COVID-19, the chances are that the schools in this study had started embracing ICT education long before the pandemic which could be the reason for the high technology skills that learners displayed.

5.2.2.7 Learners' responses on devices most used by teachers for teaching and learning

Since this study focused on the use of ICTs to improve teacher and learner performance, another question asked participants to mention the devices that teachers used for teaching and learning.

Table 5.11: Devices used often by teachers in teaching and learning

		Responses n %				**Total sample**	
		Yes		**No**			
Questions		**n**	**%**	**n**	**%**	**n**	**%**
Devices mostly used by the teacher	Does your teacher use a smart board?	46	54.1	39	45.9	85	100
	Does your teacher use a Data projector?	19	22.4	66	77.6	85	100
	Does your teacher use an Overhead projector?	39	45.9	46	54.1	85	100
	Does your teacher use a whiteboard?	52	61.2	33	38.8	85	100
	Does your teacher use interactive whiteboard (Not smart board)?	30	35.3	55	64.7	85	100
	Does your teacher use a chalkboard?	31	36.5	54	63.5	85	100
	Does your teacher use video lab?	7	8.2	78	91.8	85	100
	Does your teacher use Smart Lab?	3	3.5	82	96.5	85	100
	Does your teacher not use any of the listed?	3	3.5	82	96.5	85	100

As Table 5.11 indicates, out of 85 learner respondents, only 54.1% (n=46) acknowledged that their teachers used smart boards, 22.4% (n=19) said they used data projectors in the classroom, 45.9% (n=39) said they used overhead projectors, while 61.2% (n=52) agreed that their teachers use whiteboards. About 35.3% (n=30) of learners indicated that their teachers used interactive whiteboards. On the other hand, 36.5% (n=31) learners mentioned that their teachers used chalkboards, while 8.2% (n=7) said teachers used videos and 3.3% (n=3) saying their teachers used smart laboratories. Some 3.5% (n=3) acknowledged that their teachers used other instruments not on the list for teaching. Lastly, 3.5% (n=3) learners indicated that their teachers did not use any of the listed devices for teaching and learning in the classrooms. It can be concluded that many teachers from all schools were not using ICT and ICT-related instruments for teaching and learning, casting a doubt whether the use of ICTs in all five schools is effective and helping to improve learner and teacher performance. It is possible that teachers' lack of ICT devices exacerbated their lack of skills as indicated in the previous paragraphs. Similarly, in his study, Shava (2022:87) confirmed that teachers do not possess vital digital expertise to successfully implement ICTs in schools.

5.2.2.8 Frequency with which learners use educational resources in class

The aim of the eighth question was to establish the number of learners who used certain ICT-related activities in class to assess their level of exposure. This would help determine whether these activities contributed to teacher and learner performance in selected Soweto schools. Data that emanated from this question is presented in Table 5.12.

Table 5.12: Frequencies with which learners use educational resources in class

Questions		**Responses**								**Total sample**
		Never		**Several times a month**		**At least once a month**		**Every day or almost everyday**		
		n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**
How frequently are the activities used in the classroom	How frequently do you search the internet for content taught in class?	37	43.5	8	9.4	14	16.5	26	30.6	85
	How frequently do you search for learner Resources used in class e.g., worksheets, past exam papers?	25	29.4	22	25.9	13	15.3	25	29.4	85
	How frequently do you use application Word, PowerPoint, Excel?	4	4.7	12	14.1	21	24.7	48	56.5	85
	How frequently	45	52.9	6	7.1	26	30.6	8	9.4	85

Questions		Responses								Total sample
		Never		Several times a month		At least once a month		Every day or almost everyday		
		n	%	n	%	n	%	n	%	n
	do your learners use digital learning content e.g., Online quizzes?									
	How frequently do your learners complete learners exercises online?	42	49.4	13	15.3	15	17.7	15	17.7	85
	How frequently do you look for online professional development opportunities?	45	52.9	10	11.8	28	32.9	2	2.4	85

Six questions were asked to find out how frequent certain activities were used in the classroom. Data collected in Table 5.12 above revealed that a total all 85 learners were able to respond to six questions asked. When asked if they have ever searched the internet for content taught in class, 43.5% (n=37) said they have never searched the internet for content taught in class, 9.4% (n=8) said they used it several times a month, 16.5% (n=14) said they used it at least once a week while 30.6% (n=26) said they used it every day or almost every day. On whether they have searched for content, resources used in class e.g., worksheets, past exam papers, 29.4% (n=25) said they never used it, 25.9% (n=22) said they used it several times a month, while 15.3% (n= 13) said they used it at least once a week and only 29.4% (n=25) said they used it every day or nearly every day.

When asked if they have used applications like Microsoft Word, PowerPoint and Excel, 4.7% (n=4) said they never used them, 14.1% (n=12) said they used the applications several times a month while 24.7% (n=21) said they used them at list once a week and 56.5% (n=47) agreed to using them every day. Responding to whether they used digital learning content e.g., online quizzes, 52.9% (n=45) indicated that they never used digital learning content, 7.1% (n=6) while 30.6% (n=26) indicated they used it at least once a week and only 9.4% (n=8) indicated they used it every day. On whether they have ever completed learner exercises online, 49.4% (n=42) of the participants revealed that they never completed online exercises, 15.3% (n=13) pointed out they completed online exercises several times a month while 17.7% (n=15) admitted to completing online exercises at least once a week with also 17.7% (n=15) also pointing out that they complete online exercises every day.

Lastly the findings from the table revealed that when participants were asked if they looked for online professional developments opportunities, 52.9% (n=45) conceded that they never did, 11.8% (n=9) indicated they do it several times a month, while 32.9% (n=28) do it at least once a week and a mere 2.4% indicated that they do it every day or almost every day. It can be concluded from the findings that there is a poor use of ICT-related activities in the five schools that were involved in the study. Most learners indicated that they never used ICT-related applications and software for their school-related activities. This is a huge set back since it will negatively impact Soweto secondary schools in using ICTs to improve learners and teachers' performance. This could have been caused by several factors such as connectivity issues, a lack of skills and a lack of technical support. This aligns with Tigere's (2020:119) findings which highlighted a lack of infrastructure, a lack of finances to purchase software, a lack of skills, and connectivity problems as some of the major challenges that hinder the successful implementation of ICTs in some South African schools.

5.2.2.9 Learners' awareness of certain ICT learning platforms

This question sought to identify the number of learners that were aware of ICT-related sites that are useful for teaching and learning. Obviously for learners to improve their ICT competencies they have to acquaint themselves with a variety of ICT-related sites.

Table 5.13: Learners' awareness of certain learning platforms

Question	**Yes**		**No**		**Total sample**	
	n	**%**	**n**	**%**	**n**	**%**
Are you aware of Thutong?						
School A	0	0.0	19	100	19	100
School B	5	35.7	9	64.3	14	100
School C	0	0.0	18	100	18	100
School D	2	13.3	13	86.7	15	100
School E	0	0.0	19	100	19	100
Total	7	8.2	78	91.8	85	100
Are you aware of Cyber classroom?						
School A	3	15.8	16	84.2	19	100
School B	0	0.0	14	100	14	100
School C	1	5.6	17	94.3	18	100

Question	Yes		No		Total sample	
	n	%	n	%	n	%
School D	4	26.7	11	73.3	15	100
School E	0	0.0	19	100	19	100
Total	8	9.4	80	90.6	85	100
Are you aware of E-books?						
School A	9	50.0	9	50.0	19	100
School B	3	21.4	11	78.6	14	100
School C	2	11.1	16	88.9	18	100
School D	10	66.7	5	33.3	15	100
School E	19	100	0	0.0	19	100
Total	43	50.6	42	49.4	85	100
Are you aware of Siyavula?						
School A	8	42.1	11	57.9	19	100
School B	12	85.7	2	14.3	14	100
School C	16	88.9	2	11.1	18	100
School D	13	86.7	2	13.3	15	100
School E	19	100	0	0.0	19	100
Total	68	64.7	17	35.3	85	100
You do not know any of the listed books						
School A	4	21.1	15	78.9	19	100
School B	1	5.3	13	94.7	14	100
School C	0	0.0	18	100	18	100
School D	1	6.7	14	93.3	15	100
School E	0	100	19	100	19	100
Total	6	7.1	79	92.9	85	100

Table 5.13 reveals that not so many learners from all five schools knew about Thutong. In all five schools, Schools A, C and D had zero learners who knew about Thuthong. However, in the other two schools, a few learners knew about Thuthong. School B had 35.7% (n=5) who knew about Thuthong while School D had 11.1% (n=2). Pertaining whether learners knew about Cyber classrooms, again not so many learners were aware of it. For instance, in School B and E not even one learner knew about Cyber classrooms. In the other three schools, School A had 15.8% (n=3), School C had 5.6% (n=1) and School D had 26.7% (n=4) learners who knew about Cyber classrooms. When it comes to E-books, the table indicates that the responses varied from school to school. School A had 50% (n=9) learners who knew about E-books, School B had 21.4% (n=3), School C had 11.1% (n=2), School D had 66.7% (n=10) and in School E, 100% (n=19) learners knew about E-books. The table further reveals that School A had 42.1% (n=8), School B had 85.7% (n=12), School C had 88.9% (n=16), School D had 86.7% (N=13) and School E had 100% (n=19) learners who knew Siyavula.

Lastly the findings from the table indicate that only two schools had learners who did not know all four learning platforms. School A had 21.1% (n=4) and School D had 5.3% (n=1) learners not knowing all four learning platforms. When combining all the schools together, 8.2% (n=7) of the participants knew about Thuthong while 91.8% (n=78) did not know about it. When it came to the Cyber Classroom, only 9.4% (n=8) were aware of the Cyber classroom while 90.6 were not. With regard to E-books 50.6% (n=43) of the participants admitted knowing E-books while 49.4% (n=54) had no idea at all about E-books. Findings further revealed that 64.7% (n=68) were aware of the Siyavula learning platform while 35.3% (n=27) were not familiar with the platform at all. Surprisingly, 7.1% (n=6) of all the participants knew nothing at all about all the learning platforms. In conclusion, it is worrisome to have many learners not being aware of the learning platforms. However, what is concerning from the findings is that many learners are not aware of the four learning platforms mentioned in the study. Therefore, it means that the learners are already legging behind when it comes to ICTs in their respective schools and it is a major concern. The main problem could be that teachers in different schools are not doing enough to promote the learners' use of ICTs. Therefore, most learners are not revealed to certain learning platforms. This confirms Raman and Yamat's (2017:11) findings that some teachers are reluctant to integrate technology into their teaching.

5.2.2.10 Learners' access to subject content using ICTs

This question was crucial in establishing the number of learners who can access subject content using ICTs. The reason is that if learners can be competent in the use of ICTs, they can use these ICT skills in their schools.

Table 5.14: Learners' access to subject content using ICTs

Question			**Frequency**	**Percent**	**Total Sample**	**Percent**
Are you able to access subject content using ICTs?	School A	Yes	11	57.9		
		No	8	42.1		
		Total	19	100	19	100
	School B	Yes	10	71.4		
		No	4	28.6		
		Total	14	100	14	100
	School C	Yes	17	94.4		
		No	1	5.6		
		Total	18	100	18	100

Question			Frequency	Percent	Total Sample	Percent
	School D	Yes	15	100		
		No	0	0		
		Total	15	100	15	100
	School E	Yes	19	100		
		No	0	0		
		Total	19	100	19	100
	Total		85	100	85	100

The data displayed in Table 5.14 show that in School A 57.9% (n=11) of learners had access to subject content using ICTs, School B had 71.4% (n=10), School C had 94.4% (n=17), School D had 100% (n=15) and School E had 100% (n=19). Looking at the overall percent of learners who could access subject content using ICTs, 18.8% (n=16) of the learners did not know how to access subject content using ICT while 82. 8% (n=69) knew how to access the subject content using ICT. In conclusion, the number of learners who said they could access subject content using ICT is very high and quite pleasing. This is a very good sign and a boost for learners if they want to improve their performance through adopting the use of ICTs in their learning in their schools.

5.6.10.1 Learners reasons for not being able to access subject content

Table 5.15 discloses that learners from all five schools gave valid reasons for not being able to access subject content using ICTs.

Table 5.15: Reasons for not being able to access subject content

Question	Yes		No		Total sample	
	n	%	n	%	n	%
I need training.						
School A	3	15.8	16	84.2	19	100
School B	3	21.4	11	78.6	14	100
School C	0	0.0	18	100	18	100
School D	0	0.0	15	100	15	100
School E	0	0.0	19	100	19	100
Total	6	7.1	79	82.9	85	100
I don’t know how to do it/ I have never used it.						
School A	1	5.3	18	74.7	19	100
School B	0	0.0	14	100	14	100

Question	Yes		No		Total sample	
	n	%	n	%	n	%
School C	0	0.0	18	100	18	100
School D	0	0.0	15	100	15	100
School E	0	0.0	19	100	19	100
Total	1	1.2	84	98.8	85	100
I need internet connection						
School A	3	15.8	16	84.2	19	100
School B	1	7.1	13	92.9	14	100
School C	0	0.0	18	100	18	100
School D	0	0.0	15	100	15	100
School E	0	0.0	19	100	19	100
Total	4	4.7	81	95.3	85	100

In School A 15.8% (n=3) of learners said they needed training, 5.3% (n=1) did not know how to use ICTs and 15.8% (n=3) cited connectivity as the major hindrance. School B had 21.4% (n=3) learners who said lack of training was the major reason while a mere 7.1% (n=1) argued that connectivity was the reason for them not being able to access subject content using ICTs. Learners in Schools C, D and E did not give any reasons. Overall, 7.1% (n=6) of the learners do not have the skills to access subject content using ICTs, 3.6% (n=3) of the learners still need training on how to access subject content using ICTs while another 3.6% (n=3) of the learners were complaining of connectivity issues and 85.9% (n=73) of the learners knew how to access subject content using ICTs. Therefore, the number of learners who can access subject content using ICTs is very high and pleasing. This confirms Chisango’s (2019:52) claim that global connectivity is improving although it is still slow in developing countries.

5.5.2.11 Learners’ responses on what computers should be used for

The question was meant to establish what number of learners had an idea of what computers and the internet should be used for. The information was going to be vital when compiling states on the level of ICT awareness in Soweto secondary schools. By knowing the level of awareness stakeholders will be able to provide appropriate help to respective schools and to learners.

Table 5.16: Computers and the internet should be used for searching for learner resources

Question	**Strongly disagree**		**Disagree**		**Agree**		**Strongly agree**		**Total sample**	
Computers and internet should be used for:	n	%	n	%	n	%	n	%	n	%
Searching for learner resources										
School A	0	0	1	5.3	13	68.4	5	26.3	19	100
School B	0	0	0	0	7	50.0	7	50.0	14	100
School C	0	0	3	16.7	9	50.0	6	33.3	18	100
School D	0	0	1	6.6	7	46.7	7	46.7	15	100
School E	3	15.8	0	0	0	0	16	84.2	19	100
Total	3	3.5	5	5.9	36	42.4	41	48.2	85	100
Prepare lessons and preparations										
School A	1				7		11			
School B					12		2			
School C			1		11		6			
School D	1				6		8			
School E	3						16			
Total	5	5.9	1	1.2	36	42.3	43	50.6	85	100
Creating your own content										
School A			3		13		3			
School B			6		6		2			
School C					12		6			
School D	1				5		9			
School E					1		18			
Total	1	1.2	9	10.6	37	43.5	38	44.7	85	100
Prepare learner exercises										
School A			2		10		7			
School B					9		5			
School C	1		1		9		7			
School D			1		6		8			
School E	3				1		15			
Total	4	4.7	4	4.7	35	41.2	42	49.4	85	100
Assessing and providing learners with feedback										
School A			2		9		8			
School B	1		1		8		4			
School C			4		8		6			
School D					9		6			

Question	Strongly disagree		Disagree		Agree		Strongly agree		Total sample	
School E	3				11		5			
Total	4	4.7	7	8.2	45	53.0	29	34.1	85	100
Look for online professional development opportunities										
School A			1		6		12			
School B			1		8		5			
School C			1		8		9			
School D					3		12			
School E	1				14		4			
Total	1	1.2	3	3.5	39	45.9	42	49.4	85	100

Findings presented in Table 5.16 reveal that when learners were asked if computer and the internet should be used for searching for learner resources, 3.5% (n=3) strongly disagreed, 5.9% (n=5) disagreed, 42.4% (n=36) agreed and 48.2% (n=41) strongly agreed. On whether computers and the internet should use for lessons and presentations, 5.9% (n=5) strongly disagreed, only 1.2% (n=1) disagreed while 42.3% (n=36) agreed and 50.6% (n=43) strongly agreed. Responding to whether computers and the internet must be used for creating own content, 1.2% (n=1) strongly disagreed, 10.6% (n=9) disagreed while 43.53% (n=37) agreed and 44.7% (n=38) strongly agreed.

The table further revealed learners' responses when asked if computers and the internet must be used for preparing learner exercises. About 4.7% (n=4) strongly disagreed and another 4.7% (n=4) disagreeing. On the contrary, 41.25% (n=35) of the learners agreed while 49.4% (n=42) strongly agreed. With regard to whether computers and the internet should be used for assessing and providing learners with feedback, 4.7% (n=4) strongly disagreed and 8.2% (n=7) disagreeing. On the other hand, 53.0% (n=45) learners agreed with 34.1% (n=29) strongly agreeing.

Lastly the findings point out that when learners were asked if computers and the internet should be used to look for professional development opportunities, 1.2% (n=1) of the learners strongly disagreed with only 3.5% (n=3) disagreeing while 45.9% (n=39) agreed and 49.4% (n=42) strongly agreeing. In conclusion, it is evident from the findings in Table 5.16 that learners were mostly in agreement with computers being used for searching for learner sources, preparing lessons and presentations, creating own content, preparing learner exercises, assessment and providing learner feedback, and looking for online professional opportunities. In some instances, the learners even indicated that they strongly agree. It is only a sizeable number of learners that indicated that they do not agree.

5.5.2.12 Learners' responses on whether they need assistance with ICT-related applications

The question was necessary to identify learners that were still requiring assistance in certain ICT-related activities. When knowing the number of learners who are still struggling with certain ICT issues, stakeholders responsible for making sure that all learners in these schools are ICT competent would be in a better position to assist learners accordingly.

Table 5.17: Frequencies on assistance with ICT-related applications

Questions		YES		NO		Total Sample	
		n	Percent	n	Percent	n	Percent
Help with ICT-related applications	Do you need assistance to produce a document using Word?	6	7.1	79	92.9	46	100
	Do you need assistance to produce a presentation using PowerPoint?	35	41.2	50	58.8	46	100
	Do you need assistance to produce a spreadsheet using Excel?	38	44.7	47	55.3	46	100
	Do you need assistance to create interactive content on smart board?	41	48.2	43	51.8	46	100
	Do you need assistance to use emails to communicate with others?	19	22.4	66	77.6	46	100
	Do you need assistance to use ICTs for research purposes?	23	27.1	62	72.9	46	100
	Do you need assistance for Multimedia (Downloading a video, audio equipment etc.)?	8	9.4	77	90.6	46	100
	Do you need assistance for inserting a video or audio clip into a presentation?	12	14.1	73	85.9	46	100
	Do you need assistance for sharing a video file?	3	3.5	82	96.5	46	100
	Do you need assistance to use social media for communication e.g., Facebook, twitter, skype, blogs etc.?	5	5.9	80	94.1	46	100
	Do you need with assistance any other thing not listed here?	0	0.0	46	100	46	100

Considering that 85 learners took part in the study, the data presented in Table 5.17 showed that when learners were asked if they needed assistance with producing documents using Word, 7.1% (N=6) said yes while 92.9% (n=79) said no. On whether they needed assistance to produce a presentation using PowerPoint, 41.2 (n=35)% said yes while 58.8% (n=40) said no. Learners were asked if they needed help to produce a spread sheet using Excel and 44.7% (n=38) said they did not need help and 55.3% (n=47) admitting they needed help. With regard to assistance with creating interactive content on the smart board and 48.2% (n=41) said they needed assistance while 51.8% (n=44) said they did not. Learners were further asked if they needed any assistance in using emails to communicate and 22.4% (n=19) said they did but 77.6% (n=66) said they did not need assistance.

When asked if they needed help when using ICTs for research purposes, 27.1% (n=23) of the learners admitted they needed help while 72.9% (n=62) did not need help. Responding to whether they needed help when using multimedia such as downloading videos, audio equipment etc, 9.4% (n=8) conceded they needed help, but 90.6% (n=77) did not need the help at all. Furthermore 14.1 (n=12) learners said they needed help with inserting a video or audio clip into a presentation while 85.9% (n=73) indicated they knew how to do it. When asked if they needed assistance with sharing a video file, 3.5% (n=3) said they did while 96.5% (n=82) said they did not require assistance. On whether they needed help with social media communication like Facebook, Twitter, Skype and blogs, only 5.9% (n=5) indicated they needed help, but 94.1% (n=80) indicated they needed no help.

Information presented in Table 5.17 also revealed that 100% (n=85) of the learners said they were confident in doing any other ICT-related activities without any help. In conclusion, the information revealed in Table 5.17 clearly shows that it is not in all areas that learners needed help. In fact, they were very good in some areas. The only instances where the numbers were slightly high was on the use of smart boards, PowerPoint, Excel, multimedia downloading, ICT research and inserting videos.

5.7. QUANTITATIVE DATA ANALYSIS - TEACHERS

5.7.1 Demographic Details of Teachers

The teachers who took part in the study were either in the General Education and Training (GET) band or in the FET band. The assumption was that most of these teachers have been revealed or used ICTs at their schools hence they were regarded as more knowledgeable when it comes to responding to questions in the questionnaire used for the study. The intention was to get an equal gender representation and the researcher tried his best to achieve that although this was difficult to achieve due to the voluntary nature of participation in the study. This meant the researcher had no choice but to make do with only those participants who were interested to be part of the study.

Table 5.18: Demographic information of teachers

	School A		**School B**		**School C**		**School D**		**School E**		**Total Sample**	
Factors	n	%	n	%	n	%	n	%	n	%	n	%
Gender												
Male	4	44.4	2	33.3	7	53.9	4	50	5	50	22	47.8
Female	5	45.6	4	66.7	6	46.1	4	50	5	50	24	42.2
Total	9	100	6	100	13	100	8	100	10	100	46	100
Subject Taught												
English	2	22.2	1	16.7	2	15.4	1	12.5	2	20	46	
Maths	2	22.2	2	33.3	1	7.7	2	25	1	10	46	100
Maths Literacy	2	22.2	2	33.3	1	7.7						
Physical Sciences	2	22.2	2	33.3	2	15.4	1	12.5	1	10	46	100
Vernacular Languages	2	22.2			4	30.8			3	30	46	100
Life Orientation	1	11.1	1	16.7	3	23.1	2	25	2	20	46	100
Geography	1	11.1	1	16.7					1	10	46	100
History							1		2			
CAT	1	11.1	1	16.7	1	7.7	1	12.5			46	100
IT							1	12.5			46	100
Life Sciences			1	16.7					1	10	46	100
Natural Sciences	2	22.2	1	16.7	2	15.4			1	10	46	100
EMS	1	11.1			1	7.7	1	12.5			46	100
Creative Arts							1	12.5	2	20	46	100
Accounting	1	11.1					1	12.5			46	100
Technology			1	16.7	2	15.4	1	12.5	1	10	46	100
Social Sciences									2	20	46	100
Tourism									1	10	46	100
Economics									1	10	46	100
Electronics					1	7.7					46	100
Civil Technology					1	7.7					46	100
Business studies					1	7.7					46	100
Grade Taught												
8	6	66.7	1	16.7	4	30.8	5	62.5	6	60	46	100
9	4	44.4	1	16.7	8	61.5	4	50	5	50	46	100
10	7	77.8	5	83.3	6	46.2	6	75	7	70	46	100

	School A		School B		School C		School D		School E		Total Sample	
11	5	55.6	4	66.7	6	46.2	3	37.5	6	60	46	100
12	5	55.6	3	50	9	69.2	4	50	1	10	46	100
Teaching Experience												
0 - 10	6	66.7	3	50	5	33.5	5	62.5	5	50	46	100
11 - 20	1	11.1	1	16.7	4	30.8	1	12.5	4	40	46	100
21 -30	2	22.2	1	16.7	3	23.1	1	12.5	1	10	46	100
30 - 40			1	16.7	1	7.7	1	12.5			46	100
Total	9	100	6	100	13	100	8	100	10	100	46	100
Highest Academic Qualification												
Post Matric certificate/Diploma	2	22.2			2	15.4	1	12.5	3	30	46	100
Bachelors' degree	5	55.6	2	33.3	3	23.1	2	25	7	70	46	100
Honours Degree	1	11.1	2	33.3			1	12.5			46	100
Master's Degree					1							
Other (Advanced certificate in education)	1	11.1	2	33.3	7	53.9	4	50.0			46	100
Total	9	100	6	100	13	100	8	100	10	100	46	100

The following observations were noted in the five schools that took part in the study as depicted in Table 5.18. In total, 92% (n=46) teachers took part in the study from the intended 50 teachers. From each school the intended number of participants was 10 teachers. The following is a breakdown of the total number of teachers who took part in the study from each school:

School A – (n=9) teachers
School B – (n=6) teachers
School C – (n=13) teachers
School D – (n=8) teachers
School E – (n=10) teachers
Total – (n=46) teachers

Furthermore, it can be deduced from Table 5.18 that 47.8% (n = 22) of the respondents from the total sample were male while 42.2% (n=24) were females. Thus, there were more females' respondents than males. The table also reveals that Schools A, C and E had the most participants while Schools B and D had the least. The low number of participants in other schools could have been a result of the unanticipated and unprecedented problem of the COVID-19 pandemic that forced the closure of schools. Not all teachers were at schools due Covid-19 related sicknesses or protocols. Moreover, some teachers because of underlying sicknesses or conditions they were working from home. Therefore, the researcher had to work with the available teachers in certain schools. Nonetheless, the researcher managed to collect data from a sizeable number of participants from each school.

Information from the table also reveals that from the whole total sample (n=46), 17.4% (n=8) of teachers taught English, another 17.4% (n=8) taught Pure Mathematics, 10.9% (n=5) Mathematics Literacy, 17. 4% (n=8) Physical Sciences, 19.6% (n=9) vernacular languages, while 19.6% (n=9) teachers taught Life Orientation. Geography had 6.5% (n=3), History 6.5% (n=3), CAT 8.7% (n=4), IT only 2.2% (n=1), Life Sciences 4.3% (n=2), Natural Sciences 13% (n=6), Economic Management Sciences (EMS) 6.5% (N=3), Creative Arts (CA) 6.5% (N=3), Accounting 4.3% (n=2), Technology 10.9% (n=5), Social Sciences 4.3% (n=2), Tourism, Economics, Electronics, Civil Technology and Business Studies all had one teacher each 2.2% (n=1) teaching the subjects. However, some schools had more than one teacher per subject in certain subjects compared to other schools. For example, Schools A, C and E had more English teachers (n=2) each, Schools A, B and D had more Mathematics teachers (n=2) each, Schools A, B and C had more Physical Sciences teachers (n=2) each, Schools A and B had more Mathematics Literacy teachers (n=2) each while School C had more Life Orientation teachers (n=3).

The table also revealed grades taught by teachers from the total sample of each school. School A had (n=9) total participants. From these nine participants, 66.7% (n=6) taught Grade 8, 44.4% (n=4) taught Grade 9, 77.8% (n=7) taught Grade 10, 55.6% (n=5) taught Grade 11 and 55.6% (n=5) taught Grade 12. School B had a total of (n=6) participants and 16.7% (n=1) taught Grade 8, another 16.7% (n=1) taught Grade 9, 83.8% (n=5) taught Grade, 66.7% (n=4) taught Grade 11 and 50% (n=3) taught Grade 12. The total sample for School C was (n=13). From the (n=13) participants, 30.8% (n=4) taught Grade 8, 61.5% (n=8) taught Grade 9, 46.2% (n=6) taught Grade 10, another 46.2 (n=6) taught Grade 11 while 69.2% (n=9) taught Grade 11. School D had (n=8) total participants. The eight participants taught across all grades with 62.5% (n=5) teaching Grade 8, 50% (n=4) teaching Grade 9, 75% (n=6) teaching Grade 10, 37.5% (n=3) teaching Grade 11 and 50% (n=4) teaching Grade 12. Finally, in school E with a total of (n=10) participants, all ten teachers taught across the grades. Notably, 60% (n=6) were teaching Grade 8, 50% (n=5) taught Grade 9, 70% (n=7) taught Grade 10, 60% (n=6) taught Grade 11 and only 10% (n=1) taught Grade 12. It is evident from the data presented in the table that teachers in all five schools were teaching across grades.

When zooming in on the teaching experience of the teachers in all five schools, Table 5.18 revealed some variations on teachers' experience. The experience varied from (n=1) to (n=40) years. Breaking it down per school, School A had 66.7% (n=6) teachers whose experience ranged from 0-10 years. 11.1% (n=1) teacher fell in the experience range of 11-20 years while 22.2% (n=2) teachers were in the experience range of 21-30 years. In School B, 50% (n=3) teachers had experience ranging from 0-10 years. The 11-20, 21-30- and 30-40-years range had 16.7% (n=1) each. The findings show that the teachers who took part in this study from this school were mostly novice teachers. In School C, 33.3% (n=5) of the participants were in the 0-10 years range, while 30.8% (n=4) were in the 11-20 range. The school's 21-30 range comprised of 23.1% (n=3) while the 31-40 range had only 7.7% (n=1). School C obviously had more senior teachers who took part in the study compared to Schools A and B. School D had 62.5% (n=5) teachers in the range of 0-10 years with the ranges of 11-20, 21-30 and 31-40 all having 12.5% (n=1) respectively. It is interesting to note that the composition of teachers who took part in the study from this school is almost similar to that of School B in terms of experience. Lastly School E had 50% (n=5) teachers in the range 0-10 years' experience. The school also had 40% (n=4) of the teachers within the 11-20 range experience while only 10% (n=1) was in the range of 21-30 years' experience. It can be concluded from this finding that most of the participants who took part in the study were in the range of 0-10 years' experience. However, it still has to be established if the teacher's experience has a direct bearing on effective use of ICTs in schools with the goal of improving performance for both learners and teachers.

The qualifications of the teachers were also recorded. According to Table 5.18, School A had 22.2% (n=2) teachers with post matric qualification/diploma; 55.6% (n=5) had bachelor's degrees; while 22.2% (n=2) had honours degrees. In School B, no teachers had post matric/diploma qualifications. Instead, they had 33.3% (n=2) respectively for each of the following: bachelor's degrees, honours degrees and other qualifications. School C had 15.4% (n=2) teachers with post matric/diploma qualifications, 23.1% (n=3) teachers with bachelor's degrees and 53.7% of teachers with other teaching qualifications. Mostly these other qualifications constituted postgraduate certificate in education (PGCE). In School D, 12. 5% (n=1) teachers had post matric/diploma qualifications, 25% (n=2) with bachelor's degrees, 12.5% (n=1) with honours degrees, 12.5% (n=1) with master's degree and 37.5% of teachers with other education qualifications. Lastly, School E had 30% (n=3) of teachers with post matric/diploma qualifications and 70% (n=7) with bachelor's degrees. Therefore, according to the findings in Table 5.18, School E had the highest number of teachers with bachelor's degrees.

5.7.2 Teachers' Reponses to Questionnaire Questions

5.7.2.1 Teachers responses on having an ICT laboratory/centre

This question was necessary to ascertain whether the schools selected had ICTs in place. If ICTs were in place at the school and the schools had computer laboratories or computer centres, it meant that teachers were revealed to computers and ICT instruments in their respective schools.

Table 5.19: Teachers' responses on having an ICT laboratory/centre

Question	**School A**		**School B**		**School C**		**School D**		**School E**		**Total Sample**	
Do you have an ICT Laboratory/centre	n	%	n	%	n	%	n	%	n	%	n	%
Yes	5	55.6	5	83.3	8	61.5	4	50	9	90	31	67.4
No	4	44.4	1	16.7	5	38.5	4	50	1	10	15	22.6
Total	9	100	6	100	13	100	8	100	10	100	46	100

The data projected in Table 5.19 reveals that School A, 55.6% (n=5) said they had an ICT centre while 44.4% (n=4) said they did not have. In School B, 83.3% (n=5) of teachers indicated they had a computer centre with only 16.7% (n=1) indicating they did not have. School C had 61.5% (n=8) indicating they had an ICT centre with 38.5% (n=5) teachers saying they do not have an ICT centre. As for School D, the response of those who said they had a computer centre and those who said they did not have was similar. It was 50% (n=4) saying they have and 50% (n=4) saying they did not have. In School E, 90% (n=9) said had an ICT centre with only 10% (n=1) saying they did not have. It is clear from the findings that like with the learners; there were also teachers who did not of any ICT centre in their respective schools. What is not known is whether it was due to the teacher's ignorance about ICTs in their schools or other underlying reasons that the researcher might not have picked up. School D was the worst with half the teachers from the sample indicating that their school did not have an ICT centre. Overall, 67.4% (n=31) teachers from the total sample responded saying their schools had computer laboratories/centres, while 22.6% (n=15) indicated they did not.

5.7.2.2 Teachers' responses on the number of computers at the schools

This question sought to establish the number of computers at each school to ascertain the use of ICTs in the schools.

Table 5.20: Responses on the number of computers in the ICT laboratory/centre

Number of computers in the computer laboratory/centre	**School A**		**School B**		**School C**		**School D**		**School E**		**Total Sample**	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
	20	20.6	15	15.5	32	33	10	10.3	20	20.6	97	100

The findings in Table 5.20 show that learners in School A had (n=20), computers, School B (n=15), School C (n=32), School D (n=10) while School E had (n=20) computers. However, the responses of the teachers on the number of computers in most of the schools did not match the learners' responses. This is confusing and makes one wonder who exactly between teachers and learners gave the correct answers. One of the reasons teachers gave conflicting responses could be that most of them had no access to these ICT centres except for ICT teachers. Nevertheless, one would want to believe that teachers would know better about computer numbers at schools that learners, especially CAT and IT teachers. Since ICT teachers formed part of the sample for this study, the researcher was tempted to take the teachers responses as more accurate than those of learners. In conclusion, Schools A, C and E had the greatest number of computers while schools, B and D had the least.

5.7.2.3 Teachers' responses on the different software they use

Knowing software applications that teachers use in the selected schools was vital to establish their level of ICT competence. This will in turn assist those who give in-service training to teachers to know where most teachers are lagging behind in terms of ICT skills. Data gathered from all five schools is shown in Table 5.21 below.

Table 5.21: Teachers' responses on different software they use

Question	**YES**		**NO**		**Total**	
Have you ever used computers for lesson preparation in the last 6 months?						
	n	**%**	**n**	**%**	**n**	**%**
School A	8	88.9	1	11.1	9	100
School B	3	50.0	3	50.0	6	100
School C	8	61.5	5	38.5	13	100

Question	YES		NO		Total	
School D	7	87.5	1	12.5	8	100
School E	9	90.0	1	10.0	10	100
Total	35	76.1	11	23.9	46	100
Have you ever used computers for teaching in class in the last 6 months?						
School A	8	88.9	1	11.1	9	100
School B	4	66.7	2	33.3	6	100
School C	9	69.2	4	30.8	13	100
School D	6	75.0	2	25.0	8	100
School E	7	70.0	3	30.0	10	100
Total	34	73.9	12	26.1	46	100
Have you ever used computers for School management and administration related tusks (e.g. Planning, Timetabling, mark sheets etc.) in the last 6 months?						
School A	9	100	0	0.0	9	100
School B	5	83.3	1	16.7	6	100
School C	9	69.2	4	30.8	13	100
School D	7	87.5	1	12.5	8	100
School E	8	80.0	2	20.0	10	100
Total	38	82.6	8	17.4	46	100

As depicted in Table 5.21, three sub-questions were asked. The first sub-question wanted to establish the number of teachers who had used computers for lesson planning in the last six months. The second question wanted to establish the number of teachers who had used computers for teaching in class in the past six months, while the third question wanted to establish the number of teachers who had used computers for management and admiration purposes in the past six months. The table indicates that 76.1% (n=35) of the total respondents agreed that they have used computers for lesson planning in the last 6 months while 23.9% (n=11) said they did not. The table further revealed the number of teachers per school who had used computers in the last 6 months. School A had 89.9% (n=8) teachers acknowledging they had used computers for lesson planning in the last six months, School B had 50% (n=3), School C had 61.5% (n=8) School D 87.5% (n=7) while School E had 90% (n=9). Almost all schools had a relatively high response regarding this question except School B which was a bit low with a 50% (n=3).

The second question sought to establish the number of teachers who had used computers for learning teaching in class and 73.9% (n=34) said yes while only 26.1% (n=12) said no. Again, the responses from all five schools differed. School A had 88.9% (n=8) teachers who said yes, School B had 66.7% (n=4), School C had 69.2% (n=9), School D had 75% (n=6) and School E had 70% (n=7). The responses to this question in all schools were relatively high. This was encouraging because most teachers in all five schools were using ICTs for lesson preparation, teaching and learning and management and administration purposes.

In response to the third question which sought to establish the number of teachers who used computers for management and administration purposes, 82.6% (n=38) agreed that they used the computers while 17.4% (n=8) teachers said no. Breaking it down per school, Table 5.21 revealed that School A had had 100% (n=9) teachers who said they did, School B had 83.3% (n=5), School C had 69.2% (n=9) School D had 87.5% (n=7) while School E had 80% (n=8).

The responses from all schools were high indicating a high use of computers for management and administration activities at schools. The results are consistent with the findings of Mhlanga and Moloi (2020: 9) that during COVID-19 there was a high use of zero-rated applications and websites by teachers. They further asserted that the education system in South Africa massively adopted the use of ICTs.

5.7.2.4 Teachers responses on their confidence level in using computers and other ICT instruments

The aim of the question was to establish teachers' confidence in using computers and other ICT instruments. This was very important since it is no secret that the world is changing when it comes to the use of ICTs. Everywhere you go in this era, most people are talking about the 4IR. This means that teachers should get themselves ready to fit in the new technological workplace.

Table 5.22: Responses on teachers' confidence in using computers and other ICTs

Question		**School A**		**School B**		**School C**		**School D**		**School E**		**Total Sample**	
		n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
How confident are you in using computers and other ICT instruments?	Very confident	5	55.6	0	0	4	30.8	2	25.0	4	40.0	15	32.6
	Confident	1	11.1	4	66.7	4	30.8	3	37.5	5	50.0	17	37
	Fairly confident	2	22.2	1	16.7	2	15.4	2	25.0	0	0.0	7	15.2
	Not confident	1	11.1	1	16.6	3	23.0	1	12.5	1	10.0		15.2
	Total	9	100	6	100	13	100	8	100	10	100	46	100

The results in Table 5.22 show that in school A 55.6% (n=5) teachers indicated they were very confident in using computers and other ICTs 11.1% (n=1) indicated they were confident, 22.2% (n=2) were fairly confident and only 11.1% (n=1) were not confident. In School B 66.7% (n=4) indicated they are confident in using computers and other ICTs, 16.7% (n=1) were fairly confident while another 16.7% (n=1) indicated they were not confident. School C had 30.8% (n=4) teachers who were very confident, another 30.8% (n=4) confident, 15.4% (n=2) fairly confident and 23.0% (n=3) who were not confident at all. Teachers in School D also gave their responses on how confident they were in using computers and other ICT instruments. About 25% (n=2) indicated they were very confident, 37.5% (n=3) were confident, 25% (n=2) were fairly confident while only 12.5% (n=1) indicted they were not confident. Finally, in School E, 40% (n=4) teachers pointed out they were very confident when it comes to the use of computers and other ICT instruments, 50% (n=5) pointed out they were confident while only 10% (n=1) pointed out not being confident.

Overall, 6 (66.7%) teachers indicated that they were confident or very confident in using computers. The number who were fairly confident or not confident in using computers was 3 (32.3%). Therefore, more teachers were confident in using computers. This is consistent with Shatri's (2020:420) claim that providing pedagogical training to teachers helps them become confident when using the same ICT tools in the classroom. However, the findings from this study are different from those in other recent studies by Nyhathi (2022:77) and Ngobe (2023:52) that South African teachers still lack confidence in using ICTs.

5.7.2.5 Teachers' responses on having necessary skills to use computers and other ICT instruments

Knowing the skills teachers have in using computer and other ICT instruments will help in making sure that training providers on ICT know exactly what skill teachers need (Ngobe, 2023:62). This will go a long way towards making sure that all teachers in secondary schools have the necessary skills when it comes to the use of computers and ICTs.

Table 5.23: Responses of teachers' computer and other ICT skills

Question	Responses	School A		School B		School C		School D		School E		Total Sample	
		n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Do have the necessary skills to use computers and other ICTs?	Yes	8	88.9	5	83.3	9	69.2	8	100	8	80.0	38	82.6
	No	1	11.1	1	16.7	4	30.8	0	0.0	2	20.0	8	17.4
	Total	9	100	6	100	13	100	8	100	10	100	46	100

Findings from Table 5.23 reveal that in all five schools, a substantial number of teachers indicated they had the necessary computer and other ICT skills. School A had 88.9% (n=9) learners who said they had the computer and other ICT skills, School B had 83.3% (n=5), School C 69.2% (n=9) School D had 100% (n=8) while School E had 80.0%. Overall, 82.6% (n=38) teachers from the total sample agreed that they had the necessary skills to use computers and other ICT instruments, while 17.4% (n=8) said that they did not. A conclusion can be drawn that the awareness and computer levels in all five schools was relatively high. The high number of teachers who indicated that they had computer skills is encouraging. As Rana and Rana (2020:36) assert, when teachers have insufficient ICT skills, they tend not use the ICTs in the classroom. This suggests that ongoing ICT training is important for teachers to use technological tools effectively.

5.7.2.6 Teachers' responses on why they do not have computer and other ICT instruments skills

It is clear from the information revealed in Table 5.24 that many teachers from the total sample lacked computer and other ICT skills.

Table 5.24: Responses on why teachers do have computer and other ICT skills

Question	Responses	School A		School B		School C		School D		School E		Total responses	
		n	%	n	%	n	%	n	%	n	%	n	%
What are your reasons for not having the skills?	Don't have access to a computer	1	11.1	1	16.7	1	7.7	0	0.0	0	0.0	3	6.5

Question	Responses	School A		School B		School C		School D		School E		Total responses	
		n	%	n	%	n	%	n	%	n	%	n	%
	No internet connection	0	0.0	0	0.0	1	7.7	0	0.0	1	10	2	4.4
	Did not get training	0	0.0	0	0.0	2	15.4	0	0.0	1	10	3	6.5
	N/A	8	88.9	5	83.3	9	69.2	8	100	8	80	38	82.6
Total		9	100	6	100	13	100	8	100	10	100	46	100

Findings in Table 5.24 depicts that only 17.4% (n=8) teachers from all five schools gave reasons for why they had no computer and other ICT skills. When looking at schools individual, School A, had only 11.1% (n=1) participant who indicated not having access to a computer as a reason for not having computers skills. School B and C both had one participant (n=1) that also pointed out not having access to a computer as a reason for lacking computers skills. In School D, no participant gave a reason since they all participants indicated they had the skills. However, In School E, two participants gave two different reasons for not having computer skills. One cited internet connectivity as the reason while the other cited lack of training as a reason. Rather, more teachers from the total sample were revealed to computers and training. This is encouraging and shows that the school was moving in the right direction. As Shuro (2020:59) argues, when schools use ICTs and when teachers are trained on their use, schools experience improved academic performance while giving teachers an opportunity to give individual attention to students.

5.7.2.7 Teachers' responses on device they mostly use for teaching and learning

Identifying what devices teachers use most often is key to establish teachers' level of competences when it comes to the use of computers and other ICT instruments. If this is not done assumptions will be made on teachers' capability to use these devices and this can lead to the teaching and learning process being jeopardised. However, this is not possible if schools do not create a conducive environment for the use of ICTs in their schools (Arends, 2021:146). This means that when a conducive environment for ICTs is not created, teachers will not have ICT devices to use.

Table 5.25: Responses of teachers on devices mostly used for teaching and learning

Questions		Responses				Total sample	
		Yes		No			
		n	%	n	%	n	%
Devices mostly used by the teachers	Do you use a smart board for teaching and learning?	25	54.3	21	45.7	46	100
	Do you use a Data projector for teaching and learning?	13	28.3	33	71.7	46	100
	Do you use an Overhead projector for teaching and learning?	10	21.7	36	79.3	46	100
	Do you use a whiteboard for teaching and learning?	31	67.4	15	32.6	46	100
	Does you use interactive whiteboard (Not smart board) for teaching and learning?	6	13.0	40	87.0	46	100
	Do you use a chalkboard for teaching and learning?	25	54.3	21	45.7	46	100
	Do you use smart videos for teaching and learning?	12	26.0	34	74.0	46	100
	Does you use Smart Lab for teaching and learning?	3	6.5	43	93.5	46	100
	Does you use any other devices not listed here?	3	6.5	43	93.5	46	100

To ascertain how frequent certain activities were used in the classroom, nine questions were asked as displayed in Table 5.25. The findings from the table revealed that a total 46 teachers from all five schools answered the questions. The first question that was posed to the participants, sought to establish if the participants used smart boards for teaching and learning and 54.3% (n=25) participants said yes. When asked if they have used a data projector for teaching and learning, 28.3% (n=13) participants agreed to have used them. On using the overhead projector for teaching and learning 21.7% (n=10) participants indicated they have used it in class. The question of using a smart board for teaching and learning was responded to by 67.4% (n=31) participants who said they use it. When asked about the interactive board, 13% (n=6) agreed to using it in class. Participants were further asked if they use a chalkboard for teaching and learning and 54.3% (n=25) of the participants said yes. When also asked if they have used videos for teaching and learning, 26% (n=12) indicated they used videos for teaching and learning. Only 6.5% (n=3) pointed out they used smart lab for teaching and learning and surprisingly another 6.5% (n=3) indicated they do not use any of the mentioned devices for teaching and learning.

Therefore, looking at the data depicted in Table 5.25, we can deduce that the most used device on the list is the whiteboard followed by the smart board and then the chalkboard. Other listed devices are not frequently used according to the data presented in the table. It is at least encouraging that many teachers are using the smart boards. Smart boards are very important devises particularly in the digital age that we now find ourselves in. However, the fact that most technological tools are not being used is a big concern. Henderson (2020:1) agreed that technological tools play a vital role in supporting teaching and learning in the classroom. Therefore, it is a concern if some technological tools are not being used as per the findings of this study. However, it seems that the challenge of technological tools not being used by most teachers in schools in South Africa is ongoing. Chisango (2019:302), Zungu (2022:83) and Tigere (2022:116) confirmed that most teachers do not know how to use some of the technological tools.

5.7.2.8 Teachers' responses on how frequently they use certain activities in class

To establish how frequent certain activities were used in the classroom, participants were asked seven questions. The questions were asked to 46 participants and their responses are shown in Table 5.26.

Table 5.26: Teachers' responses on how frequently they use certain activities in class

		Responses								**Total sample**	
		Never		**Several times a month**		**At least once a month**		**Every day or almost everyday**			
Questions		**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
How frequently are the activities used in the classroom	How frequently do you search the internet for content taught in class?	6	13.0	21	45.7	12	26.1	7	15.2	46	100
	How frequently do you search for learner resources used in class e.g., worksheets, past exam papers?	5	10.9	11	26.0	16	34.8	13	28.3	46	100
	How frequently do you use application Word, PowerPoint, Excel?	7	15.2	14	30.4	15	32.6	10	21.7	46	100

Questions		Responses								Total sample	
		Never		Several times a month		At least once a month		Every day or almost everyday			
		n	%	n	%	n	%	n	%	n	%
	How frequently do your learners use digital learning content e.g., Online quizzes?	26	56.5	12	26.1	5	10.9	3	6.5	46	100
	How frequently do your learners complete learners exercises online?	10	21.7	8	17.4	9	19.6	19	41.3	46	100
	How frequently do provide feedback and assess learners?	20	43.5	8	17.4	9	19.6	9	19.6	46	100
	How frequently do you look for online professional development opportunities	16	34.8	13	28.3	8	17.4	9	19.6	46	100

The findings presented in Table 5.26 revealed that when participants were asked if they have ever searched the internet for content taught in class, 13.0% (n=6) said they have never searched the internet for content taught in class, 45.7% (n=21) said they used it several times a month, 26.1% (n=12) said they used it at least once a week while 15.2% (n=7) said they used it every day or almost every day. When asked whether they have searched for content, resources used in class e.g., worksheets, past exam papers, 10.9% (n=5) said they never used it, 26.0% (n=11) said they used it several times a month, while 34.8% (n= 16) said they used it at least once a week and only 15.2% (n=7) said they used it every day or nearly every day.

The participants were also asked if they have used applications like Microsoft Word, PowerPoint and Excel, 15.2% (n=7) said they never, 30.4% (n=14) said they used the applications several times a month while 32.6% (n=15) said they used them at list once a week and 21.7% (n=10) agreed to using them every day. Responding to whether they have used digital learning content e.g., online quizzes, 56.5% (n=26) indicated that they never used digital learning content, 26.1% (n=12) while 10.9% (n=5) indicated they used it at least once a week and 9.4 only 6.5% (n=3) indicated they used it every day. When further asked if they have ever completed learner exercises online, 21.7% (n=10) of the participants revealed that they never completed online exercises, 17.4% (n=8) pointed out they completed online exercises several times a month while 19.6% (n=9) admitted to completing online exercises at least once a week with also 41.3% (n=19) also pointing out that they complete online exercises every day.

When asked if they have used ICTs to provide feedback to learners, 43.5% (n=20) pointed out that they never used them, 17.4% (n=8) indicated they used them several times a month, with 19.6% (n=9) indicating that they use them ICTs once a month and another 19.6 (n=9) indicating they used them almost on daily basis to give feedback and assess learners. Lastly the findings from the table revealed that when participants were asked if they look for online professional developments opportunities, 34.8% (n=16) conceded that they never, 28.3% (n=13) indicated they do it several times a month, while 17.4% (n=8) do it at least once a week and a mere and 19.6% (n=9) indicated that they do it every day or almost every day.

It can be deduced from the findings that there is a poor use of ICT-related activities in all five schools because the number of teachers who indicated that they never used ICT-related applications, software, etc. for their school-related activities was significantly large. This is a huge set back since it will negatively impact Soweto secondary schools in acquiring ICT skill needed to improve learners and teachers' performance. However, the data in Table 5.26 reveals that searching the internet for content in lesson preparation was the most frequented activity, followed by the use of PowerPoint and Excel to present lessons and looking for online professional development opportunities. The least used applications according to the data presented in Table 5.26 were preparing learners' exercises with ICTs and using ICTs to provide feedback and assessment to learners. Similarly, Zungu (2022:83) highlighted that not many teachers in South African schools use ICT platforms for teaching and learning.

5.7.2.9 Teachers' responses on their awareness of different ICT-related sites

The question was posed in attempt to find out and gather data on how much teachers knew concerning the ICT-related sites that are available for their use. This was vital since all these sites help to enhance teaching and learning in the classroom for the benefit of the learners. Table 5.27 reveal the findings of data collected.

Table 5.27: Teachers' awareness of the given sites

Question	Yes		No		Total sample	
	n	%	n	%	n	%
Are you aware of Thutong?						
School A	5	55.6	4	44.4	9	100
School B	3	50.0	3	50.0	6	100
School C	7	53.8	6	46.2	13	100
School D	5	62.5	10	66.7	8	100
School E	9	90	1	10	10	100
Total	29	63.0	17	27.0	46	100
Are you aware of cyber classroom?						
School A	6	66.7	3	33.3	9	100
School B	4	66.7	2	33.3	6	100
School C	9	69.2	4	30.8	13	100
School D	5	62.5	3	37.5	8	100
School E	2	20.0	80	80.0	46	100
Total	26	56.5	20	43.5	46	100
Are you aware of E-books?						
School A	9	100	0	0.0	9	100
School B	2	33.3	4	66.7	6	100
School C	7	53.8	6	46.2	13	100
School D	5	62.5	3	37.5	8	100
School E	9	90.0	1	10.0	10	100
Total	32	69.6	14	30.4	46	100
Are you aware of Siyavula?						
School A	8	88.9	1	11.1	9	100
School B	4	66.7	2	33.3	6	100
School C	7	53.8	6	46.2	13	100
School D	4	50.0	4	50.0	8	100
School E	5	50.0	5	50.0	10	100
Total	28	60.8	18	39.2	46	100
You do not know any of the listed						
School A	0	0.0	9	100	9	100
School B	2	33.3	4	66.7	6	100
School C	2	15.4	11	88.6	13	100
School D	0	0.0	8	100	8	100
School E	0	100	10	100	10	100
Total	4	40.0	60	95.3	46	100

Table 5.27 reveals that a reasonable number of teachers from all five schools were aware of Thutong. The table indicates that there were 55.6% (n=5) teachers in School A, 50% (n=3) in School B, 53.8% (n=7) in school C, 62.5% (n=5) and 90.0% (n=9) who knew about Thutong. Pertaining Cyber classrooms, again a sizeable number of teachers from four schools except one were aware of it. In School A, 66.7% (n=6) knew about cyber classroom, with another 66.7% (n=4) in school B, 69.9% (n=9) in School C, 62.5% (n=5) in School D and only 20% (n=2) in

School E. School E was the only school with a few teachers who indicated they knew about cyber classrooms. The table further indicates that E-books were known by 69.2% (n=9) teachers in School A, 33.3% (n=2) in School B, 53.8% (n=7) in School C, 62.5% (n=5) in School D and 90% (n=9) in School E.

According to Table 5.27, Siyavula was also known by many teachers. As revealed by the table, in School A, 88.9% (n=8) teachers knew about Siyavula, School B had 66.7% (n=4), School C had 53.8% (n=7), School D had 50.0% (n=4) and School E had 50.0% (n=5) teachers who knew Siyavula. The table further indicate that Schools B and C were the only schools with (n=2) teachers each who knew none of the sites that were asked. When combining all the schools together, 63.0% (n=29) of the participants knew about Thuthong while 27.0% (n=17) did not know about Thuthong. On the question of cyber classrooms, only 56.5 (n=26) were aware of the cyber classroom and 43.5% (n=20).

With regard to E-books, 69.6% (n=32) of the participants admitted knowing E-books while 30.4 (n=14) had no idea at all about E-books. The table also revealed 60.8 (n=28) were aware of the Siyavula learning platform and 39.2% (n=18) were not familiar with the platform at all. Furthermore, the findings showed that 40.0% (n=4) of the participants knew nothing at all about all the learning platforms. It was, however, a good thing to see that a very good number of teachers were aware of the learning platforms. This is a good sign because the platforms play a pivotal role in the teaching and learning process especially considering that we are in the digital age. Similarly, Mhlanga and Moloi (2020:9) agreed that COVID-19 transformed teaching and learning in South Africa. The argue that because of COVID-19, more schools have adopted ICT tools in their teaching and learning, resorted to virtual learning and started using zero-rated applications and educational websites.

5.7.2.10 Teachers’ responses on how they access subject content using ICTs

The question sought to ascertain if teachers in Soweto secondary schools could access subject content using all ICT tools at their exposal.

Table 5.28 Teachers' responses on accessing subject content using ICTs

Question			**Frequency**	**Percent**	**Total Sample**	**Percent**
Are you able to access subject content using ICTs?	School A	Yes	9	100	9	100
		No	0	0	0	0.0
		Total	9	100	9	100
	School B	Yes	3	50.0	3	50.0
		No	3	50.0	3	50.0
		Total	6	100	6	100
	School C	Yes	9	69.2	9	69.2
		No	4	30.8	4	30.8
		Total	13	100	13	100
	School D	Yes	6	75.0	6	75.0
		No	2	25.0	2	25.0
		Total	8	100	15	100
	School E	Yes	9	100	9	100
		No	0	0	0	0.0
		Total	9	100	9	100
	Total		46	100	46	100

The data displayed in Table 5.28 show that in School A 100% (n=9) of teachers confirmed they had access to subject content using ICTs, School B had 50.0% (n=3), School C had 69.2% (n=9), School D had 75.0% (n=6) and School E had 100% (n=9). Looking at the overall percent of teachers who could access subject content using ICTs, 80.4% (n=37) of the teachers could access indicated they could access subject content using ICTs while only 19.6% (n=9) did not know how to access subject content using ICTs. The number of teachers who could access subject content using ICTs outweighed the number of teachers who could not access subject content using ICTs. This was a very good sign and a boost for teachers. When more teachers embrace ICTs, they could improve learner and teacher performance through their effective use. Shuro (2020:59) confirms that the teachers' use of ICTs to search for subject content in Ekurhuleni North primary schools leading improved academic performance and removed learning barriers.

5.7.2.11 Teachers' responses on why they cannot access subject content using ICTs

This question was raised to find out the reasons as to why some teachers could not use ICTs to access subject content. The question was necessary because it helped to address the specific problems teachers encountered trying to use ICTs to access subject content.

Table 5.29: Reasons for teachers not being able to access subject content using ICTs

Question	Yes		No		Total sample	
	n	%	n	%	n	%
I need training						
School A	0	0.0	9	100	9	100
School B	0	0.0	6	100	6	100
School C	1	7.7	12	92.3	13	100
School D	0	0.0	8	100	8	100
School E	0	0.0	10	100	10	100
Total	1	2.2	45	97.8	85	100
I don't know how to do it/ I have never used it						
School A	0	0.0	9	100	9	100
School B	0	0.0	6	100	6	100
School C	0	0.0	13	100	13	100
School D	0	0.0	8	100	8	100
School E	0	0.0	10	100	10	100
Total	0	0.0	46	100	46	100
I need Internet connection						
School A	0	0.0	9	100	9	100
School B	3	50.0	3	50.0	6	100
School C	0	0.0	13	100	13	100
School D	1	12.5	8	100	8	100
School E	1	10	9	90	10	100
Total	5	10	41	99.1	46	100

Table 5.29 indicates that teachers gave valid reasons as to why they could not access subject content using ICTs. The reasons that were given were that of lack of training, not knowing how to use a computer, and that of connectivity. Schools C is the only school which had 7.7% (n=1) participants who stated that their reason for not using ICTs to access subject content was lack of training. None of the teachers from any of the five schools mentioned that being unfamiliar with computers posed a barrier to accessing subject content through ICTs. However, with respect to connectivity, three schools gave this as a reason not using ICTs to access subject content. School B had 50% (n=3) participants arguing that connectivity issues were a barrier or that they prevented them from accessing subject content using ICTs. School D had 12.5% (n=1) and School E had 10% (n=1) teachers who also blamed connectivity as the major hindrance to accessing subject content using ICTs. It is clear from the information displayed in the Table 5.29 that in all five schools under study, teachers had similar reasons for not using

ICTs to access subject content. Similarly, Zungu (2022: 83) established that a lack of skills, connectivity challenges, a lack of resources and a lack of confidence hindered teachers from using ICTs in the classroom.

5.7.2.12 Teachers' responses on what computers and the internet must be used for

The question was asked to establish how much teachers knew about the uses of computers and the internet. This information was vital in compiling states on the level of ICT awareness in Soweto secondary school teachers. Knowing the level of awareness could assist stakeholders to provide appropriate help to respective schools and learners.

Table 5.30: Computers and the internet should be used for searching for learner resources

Question	**Strongly disagree**		**Disagree**		**Agree**		**Strongly agree**		**Total sample**	
Computers and internet should be used for:	**n**	**%**	**n**	**%**	**N**	**%**	**n**	**%**	**n**	**%**
Searching for learner resources										
School A	1	11.1	0	0.0	2	22.2	6	66.7	9	100
School B	1	16.7	0	0.0	4	66.7	1	16.7	6	100
School C	2	15.4	0	0.0	3	23.1	8	61.5	13	100
School D	1	12.5	0	0.0	3	37.5	4	50.0	8	100
School E	1	10.0	0	0.0	3	30.0	6	60.0	10	100
Total	6	13.0	0	0.0	15	32.6	25	54.4	46	100
Prepare lessons										
School A	1	11.1	0	0.0	3	33.3	5	55.5	9	100
School B	1	16.7	0	0.0	4	66.7	1	16.7	6	100
School C	2	15.4	1	7.7	4	30.8	6	46.2	13	100
School D	1	12.5	0	0.0	3	37.5	4	50.0	8	100
School E	1	10.0	0	0.0	7	70.0	2	20.0	10	100
Total	6	13.0	1	2.2	21	45.7	18	39.1	46	100
Creating your own content										
School A	1	11.1	0	0.0	4	44.4	4	44.4	9	100
School B	1	16.7	0	0.0	4	66.7	1	16.7	6	100
School C	2	15.4	1	7.7	4	30.8	6	46.1	13	100
School D	1	12.5	0	0.0	4	50.0	3	37.5	8	100
School E	1	10.0	0	0.0	5	62.5	4	50.0	10	100
Total	6	13.0	1	2.2	21	45.7	18	39.1	46	100
Prepare learner exercises										
School A	1	11.1	0	0.0	2	22.2	6	66.7	9	100
School B	1	16.7	0	0.0	3	50.0	2	33.3	6	100
School C	1	7.7	0	0.0	5	38.5	7	53.9	13	100
School D	1	12.5	1	12.5	3	37.5	3	37.5	8	100
School E	1	10.0	0	0.0	3	60.0	6	30.0	10	100
Total	5	10.9	1	2.2	16	34.8	24	49.4	46	100
Assessing and providing learners with feedback										
School A	1	11.1	0	0.0	4	44.4	4	44.4	9	100
School B	1	16.7	1	16.7	4	0.0	0	0.0	6	100

Question	Strongly disagree		Disagree		Agree		Strongly agree		Total sample	
Computers and internet should be used for:	**n**	**%**	**n**	**%**	**N**	**%**	**n**	**%**	**n**	**%**
School C	2	15.4	1	7.7	5	38.5	5	38.5	13	100
School D	0	0.0	2	25.0	3	37.5	3	57.5	8	100
School E	1	10.0	0	0.0	2	20.0	7	70.0	10	100
Total	5	10.9	4	8.7	18	39.1	19	41.3	46	100
Look for online professional development opportunities										
School A	1	11.1	0	0.0	3	33.3	6	66.7	9	100
School B	1	16.7	0	0.0	5	83.3	0	0.0	6	100
School C	2	15.4	0	0.0	4	30.8	7	53.9	13	100
School D	0	0.0	1	12.5	4	50.0	3	37.5	8	100
School E	1	10.0	0	0.0	5	50.0	4	40.0	10	100
Total	1	2.2	3	6.5	21	45.7	20	43.5	46	100

Findings presented in Table 5.30 reveal that when participants were asked if computers and the internet should be used for searching for learner resources, 13.0% (n=6) strongly disagreed while 32.6% (n=15) agreed with even 54.4% (n=25) strongly agreeing. On the question of whether computers and the internet should be used to create lessons and presentations, 13.0% (n=6) participants strongly disagreed with only 2.2% (n=1) disagreeing, while on the other hand, 45.7% (n=21) agreed and 39.1% (n=18) strongly agreed. Participants also responded to whether computers and the internet must be used for creating own content, 13.0% (n=1) strongly disagreed and 2.2% (n=1) said they disagreed. On the other hand, 45.7% (n=21) agreed with another 39.1% (n=18) strongly agreeing. The table further revealed participants' responses on whether computers and the internet must be used for preparing learner exercises. Findings show that 10.9% (n=5) strongly disagreed with another 2.2% (n=1) disagreeing. On the contrary, 34.8% (n=16) of the participants agreed while a further 49.4% (n=24) strongly agreeing. When participants were also asked whether computers and the internet should be used for assessing and providing learners with feedback, 10.9% (n=5) strongly disagreed while 8.7% (n=4) simply disagreed. On the other hand, 39.1% (n=18) participants agreed with the statement, with 41.5% (n=19) strongly agreeing.

Lastly the findings indicate that when participants were asked if computers and the internet should be used to look for professional development opportunities, 2.2% (n=1) of the participants strongly disagreed with 6.5% (n=3) simply disagreeing. On the contrary 45.7% (n=21) agreed that computers and the internet can be used to look for professional development opportunities while a further 43.5% (n=20) strongly agreeing to it. In conclusion, it is evident from the findings depicted in Table 5.30 that participants were mostly in agreement with computers being used for searching for learner sources, preparing lessons and presentations, creating own content, preparing learner exercises, assessment and providing learner feedback, and looking for online professional opportunities. In some instances, the participants even indicated that they strongly agree. Only a few participants indicated that they did not agree. According to the findings, more and more teachers in Soweto schools are beginning to appreciate the use of ICT tools in the classroom. Similarly, Shuro (2020:59) confirms that ICTs improve academic performance in schools. Mhlanga and Moloi (2020:9) agree that ICTs have improved academic performance in schools post-COVID-19.

5.7.2.13 Teachers' responses on whether they needed assistance with listed ICT-related activities

The question was necessary to identify teachers who still required assistance in certain ICT-related activities. When knowing the number of teachers who still struggle with certain ICT issues, stakeholders responsible for making sure that all teachers in the five schools are ICT-competent would be in a better position to assist them accordingly.

Table 5.31: Frequencies on assistance with ICT-related applications

Question		YES		NO		Total Sample	
		n	**Percent**	**n**	**Percent**	**n**	**Percent**
Help with ICT-related applications	Do you need assistance to produce a document using Word?	6	13.0	40	87.0	46	100
	Do you need assistance to produce a presentation using PowerPoint?	14	30.4	32	69.6	46	100
	Do you need assistance to produce a spreadsheet using Excel?	18	39.1	28	60.9	46	100
	Do you need assistance to create interactive content on smart board?	22	47.8	24	22.2	46	100
	Do you need assistance to use emails to communicate with others?	6	13.0	40	87.0	46	100
	Do you need assistance to use ICTs for research purposes?	10	21.7	36	78.3	46	100
	Do you need assistance for Multimedia (Downloading a video, audio equipment etc.)?	14	30.4	32	69.6	46	100
	Do you need assistance for inserting a video or audio clip into a presentation?	15	32.6	31	67.4	46	100
	Do you need assistance for sharing a video file?	8	17.4	38	82.6	46	100

Question		YES		NO		Total Sample	
		n	Percent	n	Percent	n	Percent
	Do you need assistance to use social media for communication e.g., Facebook, twitter, skype, blogs etc.?	5	10.9	41	89.1	46	100
	Do you need assistance any other thing not listed here?	3	6.5	43	93.5	46	100

The data presented in Table 5.31 show varied teachers' responses on whether they needed assistance in using some of the ICT applications or software. Teachers were asked if they needed assistance with producing documents using Word, 13.0% (n=6) said yes while 87.0% (n=40) said no. On whether they needed assistance to produce a presentation using PowerPoint, 30.4% (n=14) said yes while 69.6% (n=32) said no. When asked if they needed help to produce a spread sheet using Excel, 39.1% (n=18) said they needed assistance while 60.9% (n=28) admitted they did not need assistance. Teachers were also asked if they needed assistance with creating interactive content on the smart board and 47.8% (n=22) said yes while 22.2% (n=24) said they did not. They were further asked if they needed any assistance in using emails to communicate and 13.0% (n=6) said yes with 87.0% (n=40) saying they did not need assistance.

When also asked if they needed help when using ICTs for research purposes, 21.7% (n=10) of the teachers admitted they needed help while 78.3% (n=36) needed no help. Responding to whether they needed help when using multimedia such as downloading videos, audio equipment, etc., 30.4% (n=14) agreed that they needed help, but 69.6% (n=32) did not need the help. Furthermore 32.6 (n=15) of the teachers said they needed help with inserting a video or audio clip into a presentation while 67.4% (n=31) indicated they knew how to do it. When further asked if they needed assistance with sharing a video file, 17.4% (n=8) said they did while 82.6% (n=38) said they required no assistance. On whether they needed help with social media communication like Facebook, Twitter, Skype, blogs, etc only 10.9% (n=5) indicated that they needed help, but 89.1% (n=41) indicated they help was needed. The Table also revealed that 6.5% (n=3) of the teachers indicated that they might need help with other ICT-related activities while 93.5% (n=43) said they were confident in doing any other ICT-related activities without any help. In conclusion, the table reveals that there was a reasonable number of teachers who needed help with PowerPoint presentations, Excel, interactive smart board, multimedia downloads and inserting video or audio clips. Generally, many of them were competent in most of the ICT-related Apps, tools and software. The issue of teachers not being very competent in ICTs as revealed in this study is not new. Many recent studies have cited similar problems that hindered teachers were not using to use ICTs in teaching as indicated in Table 5.31 (Arends, 2021:140; Faturoti, 2022:840; Mfuphi, 2020: 130; Nyathi, 2022:77).

5.8 QUALITATIVE DATA ANALYSIS

The main aim of the study was to explore the responses of teachers in secondary schools in Soweto on the use of ICTs and how they contribute towards better teacher and learner performance. Recorded interviews were used to gather responses of (n=25) participants. There were five Soweto secondary schools involved in the study and five participants per school were interviewed. The participants for the interviews included at least one principal or deputy principal, one HOD and three teachers per school. The interviews were guided by the main research question 'How best can the GDE promote effective use of ICTs or e-learning programmes to improve learner and teacher performance in Soweto township public secondary schools? The participants' strategic roles, experience and exposure to ICTs in school guided the selection process. However, in situations where some targeted participants were not available, a random selection of teachers was done.

In this section, the focus is on an extensive analysis of all collected data from the five secondary schools. The section also looked at the themes and sub-themes that emerged from the interview data. However, to answer the main question, sub-questions were formulated. The following sub-questions were posed to the participants:

1. Do you think the use of ICTs in your school is contributing positively to the teaching learning process?
2. What assistance are you getting from the GDE as a school on how to effectively use ICTs in the teaching and learning process?
3. How do you as a school promote effective use of ICTs in order to improve learner and teacher performance?
4. What challenges do you have as a school in using ICTs for teaching and learning?
5. How do you mitigate or manage these challenges as a school?
6. What more can be done at your school do to make sure that ICTs are effectively used in the teaching and learning process in order to improve learner and teacher performance?

Therefore, through in-depth interviews with the participants, data was collected, analysed and discussed.

5.8.1 Demographic Information of Participants

The profiles of the participants are captured in Table 5.32 in order to provide information that differentiates them.

Table 5.32: Demographic information of teachers

School and Participants	**Gender**	**Age**	**Subjects taught**	**Phase taught**	**Designation**
School A					
Participant 01 (P01F)	F	41–50	Geography, Isizulu and Social Sciences	GET and FET	Deputy principal
Participant 02 (P02F)	F	31–40	CAT and Natural Sciences	GET and FET	HOD
Participant 03 (P03M)	M	31–40	Mathematics Literacy and pure Mathematics	GET and FET	Teacher
Participant 04 (P04M)	M	31–40	Languages and Life Orientation	GET	Teacher
Participant 05 (P05F)	F	30–40	Physical Science, Natural Sciences and Mathematics	GET and FET	Teacher
Total	5				
School B					
Participant 06 (P06M)	M	50–60	Unknown	unknown	Deputy principal
Participant 07 (P07M)	M	21–30	CAT, IT and English	GET and FET	HOD
Participant 08 (P08M)	M	40–50	Mathematics	GET and FET	Teacher
Participant 09 (P09M)	M	50–60	Civil Technology	FET	Teacher
Participant 10 (P10M)	M	50–60	Technical Sciences, Physical Sciences and Natural Sciences	GET and FET	Teacher
Total	5				
School C					
Participant 11 (P11M)	M	50–60	Unknown	unknown	Principal
Participant 12 (P12M)	M	40–50	CAT	FET	HOD
Participant 13 (P13F)	F	31–40	Physical Sciences, Mathematics Literacy	FET	Teacher
Participant 14 (P14F)	F	31–40	Technology and Life Orientation	GET	Teacher
Participant 15 (P15F)	F	30–40	English	FET	Teacher
Total	5				
School D					
Participant 16 (P16M)	M	50–60	unknown	unknown	Principal
Participant 17 (P17M)	M	30–40	CAT and IT	FET	HOD

School and Participants	Gender	Age	Subjects taught	Phase taught	Designation
Participant 18 (P18F)	F	30–40	Mathematics and Technology	GET	Teacher
Participant 19 (P19F)	F	30 -40	History and Life Orientation	FET	Teacher
Participant 20 (P20F)	F	40–50	Visual Arts	FET	Teacher
Total	5				
School E					
Participant 21 (P21M)	M	50–60	Mathematics Literacy	FET	Deputy principal
Participant 22 (P22F)	F	30–40	CAT	FET	HOD
Participant 23 (P23M)	M	30–40	History	FET	Teacher
Participant 24 (P24F)	F	20–40	Life Sciences and Geography	FET	Teacher
Participant 25 (P25M)	M	20–30	Geography	FET	Teacher
Total	5				

Table 5.32 shows participants from all five schools that were involved in the research. The composition of participants from each school included one principal or deputy principal, one HOD and three teachers. In School A there were (n =3) females and (n=2) males. The age of the participants in this school ranged from 30 years to 40 years. Most participants taught two or more subjects both in GET phase and FET phase. In School B, all the participants were males (n=5). Their age ranged from 30 to 50 years with (n=2) teachers teaching two or more subjects while another (n=2) teachers only taught one subject each. All teachers taught in both GET and FET. However, the Deputy Principal’s subject is unknown, it was not given. In School C, there were (n=3) females and (n=2) males. Their ages ranged from 30 to 50 years and (n=2) teachers taught two or more subjects while another (n=2) taught only one subject each. All teachers in this school taught in the FET phase. The principal’s subject in this school is also unknown. School D had (n=3) female participants and (n=2) male participants. Their age range was from 30 to 50 years. Four of the participants taught at least two subjects each, one in GET phase and the rest in FET phase. The principal’s subject is also unknown in this school. Finally, in School E there were (n=2) female teachers and (n=3) male teachers. The age range of the teachers was from 20 to 50 years. Three of the teachers taught two subjects each while two of the teachers taught only one subject each. All the teachers in this school who participated in the study taught in the FET phase. The table also reveals that participants were named Participant 01 to 25 respectively to protect their identity.

5.8.2 Discussion of Themes

When sub-questions were posed to the participants with the aim of understanding how effective ICTs in Soweto secondary schools were in promoting learner and teacher performance, the data analysis produced six themes and 14 sub-themes. These themes and sub-themes that emerged from the data analysis are indicated in Table 5.33 followed by in-depth discussions.

Table 5.33: Themes and sub-themes

Themes	Sub-themes
1. Positive contribution of ICTs in Teaching and learning	a. Learner assessment with ICT b. ICTs as a teaching tool c. Availability of ICTs in Schools
2. Assistance rendered by the Department of Education	a. ICT Training in Schools b. ICT software and hardware support
3. Promotion of ICTs in Schools	a. Provision of ICT equipment b. Access to ICT
4. Challenges in using ICTs in the teaching and learning process	a. Connectivity of ICTs b. Security of ICT equipment c. ICT skills
5. Mitigation of challenges	a. ICT training b. Infrastructure for ICTs c. ICT policies
6. Recommendations and suggestions	a. In-service training b. ICT back-up and security issues

5.8.2.1 Positive contribution of ICTs in teaching and learning

The positive contribution of ICTs in the teaching and learning process is the first theme that emanated from first sub-question asked: Do you think the use of ICTs in your school is contributing positively to the teaching learning process? By asking this question, the researcher sought to understand whether the use of ICTs in Soweto schools had a positive impact on the teaching and learning process.

The findings reflected thatt the majority of the respondents in all five schools**,** agreed that the use of ICTs in their schools is benefiting them positively. They pointed out how ICTs are making teaching and learning easier, especially by using smart boards. They alluded to the fact that smart boards simplify the whole teaching process and save time because they can save all their notes on it and they do not need to rewrite the notes. The participants also echoed that ICTs afforded them better and more effective ways of teaching especially through the use of videos, visuals, audios just to mention a few. Participants also emphasised how the use of ICTs helped them to explain certain concepts and topics that would have been impossible to teach without them. One even alluded to the fact that by using ICTs, they were better able to show shapes and drawings to learners since some teachers cannot draw nicely and clearly. ICTs according to these teachers also afforded them a better lesson planning and assessment platform. Simultaneously ICTs remove some boredom in the classroom and being beneficial to visual learners. Some participants' responses also addressed the sub-themes that emerged from the main theme. They mentioned how ICTs can be used as an assessment tool, as a teaching tool and their availability in schools. All this is evident in their responses that follow.

P01F (School A – Deputy Principal) said:

> *Yes, it is contributing a lot to the teaching and learning process. My subjects are so abstract and if I want to show learners things that are happening around the world it becomes easier when you use ICTs. This helps learners understand because abstract things are made concrete* (P01F).

P02F (School – HOD) articulated:

> *Yes, definitely, it is actually contributing positively. Okay. For example, now we are having smart boards. When utilisation the smart board you are having your digital pen, your digital wrapper, where you can just erase with your hand and your hand is not static* (P02F).

P03M (School A – Teacher) commented:

> *Absolutely it is contributing positively. For example, if you are teaching diverse learners, we need ICT to help us go the extra mile. ICTs will enable us to do research as it easily accessible on the internet* (P03M).

P04M (School A – Teacher) responded thus:

> *Yeah, I think it is contributing positively. Now that we are living in this time where we're talking about this fourth industrial revolution. This is putting much effort into making the teaching learning much easier* (P04M).

P05F (School A – Teacher) revealed:

> *Yes, I would say so. Because previously, you could only do illustrations physically but now you can do illustrations using a smartphone if you have one. Learners can also save lesson materials on their cell phone saving the teacher the agony of re teaching the lesson* (P05F).

At School B, only two (n=3) of the teachers were positive about the contributions ICT was making at their school. They claimed that the use of ICTs in this day and age cannot be avoided because the world is evolving in terms of ICT use. The use of ICTs according to the respondents is the new order in the twenty-first century. They alluded to the fact that the use of ICTs is making teaching and learning easier and making teaching exciting. On the contrary, it was worrying to see that two (n=2) of the teachers from the same school were very negative about the contribution of ICTs at the school. One could only assume that their responses might be linked to their bad experience with their ICTs in their school. Their responses are given below.

P06M (School B – Deputy Principal) said the following:

> *Quite frankly, it should be. It's helping to enhance teaching and learning, especially these days, technology is moving us away from using papers and moving us to become paperless schools* (P06M).

P07M (School B – HOD) replied:

> *Yes, but to a certain extent, because we do have smart boards, but some data projectors are not working. This, therefore, delays teaching and learning in the classroom. These challenges will leave us with no choice but to end up resorting to the old way of teaching which is just using the whiteboard* (P07M).

P08M (School B – Teacher) responded this way:

> *Unfortunately, I don't think so. We have smart boards but none of them are working, they are broken. Therefore, we're not implementing anything in terms of ICT in our school* (P08M).

P09M (School B – Teacher) said:

> *It is not contributing. As a teacher, I don't have a laptop. I don't have a place where I can take you to go and access or connect to the internet. The classes where I teach there is no connectivity. I teach Technology and this subject need you to use these ICTs* (P09M).

In response to the question, P10M (School B – Teacher) stated:

> *To some extend yes. Using these ICT instruments also help enhance learners' interest in the subject. However, learners are faced with the challenge of the unavailability of the laptops, but they can also use tablets and cell phones* (P10M).

At School C, all teachers agreed that the ICTs were benefiting the school. They argued that the use of ICTs helped teachers do their administrative work and to create lessons plans more easily. However, they also argued that their school had connectivity issues and complained that access to ICT instruments was also a challenge since computers were only available in the computer labs. According to the participants, one needs to book the computer labs before using them and this proved to be a challenge for many teachers. Their responses follow herewith.

P11M (School C – Principal) had the following to say:

> *I would say a bit because we don't really have access to the internet, so I can't really say it's contributing per se. There's an issue of Wi-Fi. We don't have Wi-Fi, so connectivity is a problem. We use what's up, which is convenient to teach, and send out announcements. Again, you need to make sure that you have booked the lab to avoid clashes. So, at our school we have a bit of some ICT but it's not effective* (P11M).

P12M (School C – HOD) responded as follows:

> *It definitely does. It is contributing positively because now you can store your content material on the smart board. This is different when using hard copies like textbook, you can forget them at home, and then during that lesson, you will find some difficulties in carrying on with the lesson* (P12M).

P13F (School C – Teacher) answered:

> *Yes, it contributes positively in the sense that we are becoming more efficient in terms of delivery of our lesson plans and any other administrative work. So, ICT does help us to be more efficient in our work, so it is possibly contributing positively* (P13F).

P14F (School C – Teacher) said:

> *Yes, of course, learners can get necessary information easily through ICTs. Instead of using several textbooks they can simply use their tablets and access the information they*

> *want. It also becomes easy for them even when they want to access the information at home* (P14F).

In response to this question, P15M (School C – Teacher) shared:

> *It is contributing positively because most teachers are using this ICT as a method to teach learners especially in life sciences and geography* (P15M).

All five participants in School D agreed that ICTs were contributing positively at their school although sometimes they faced some challenges. They all mentioned that access to computers for the learners was a challenge and that most of the times they had connectivity problems. They emphasised the need for teachers to get training on the use of the ICTs so they can improve their ICT skills. Their responses follow below.

P16M (School D – Principal) stated:

> *Yes, it does. The use of ICT according to my observations minimises paperwork. And things that would ordinarily take you time you have them at the tip of your fingers. For example, you can show learners specific content via the projector and by using the installed smart boards. We have everything at the tip of our fingers. For instance, you have both your content via the internet, in the form of the textbook and in your teacher guide even as a PDF* (P16M).

P17M 4 (School D – HOD) responded thus:

> *Yes, look, ICTs are very key especially in preparation for the new industrial technologies. They say the twenty-first century, the fourth industrial revolution. There's a lot, you know, our MEC talks to a bonus class, where learners can engage and research using these gadgets. It's so quick. You know, everything is there. When you want something, you simply Google and you get considerable information. Within a short space of time, you don't have to go to Siyavula is also cost-effective. Even ourselves, we can research using these e-learning material resources not necessarily googling. Yeah. So, I think it's very key* (P17M).

P18F (School D – Teacher) said:

> *ICT was introduced in October last year at our school so that learners can get ICT skills which are a very positive contribution of these ICTs to our learners* (P18F).

P19F (School D – Teacher) responded:

> *I would say to a certain extent. I say so basically because not all classes have access to these ICTs. ICT compliant, only a few classes if not two, or three are ICT compliant. Another issue is that most educators are not really trained to use ICTs. Yes, we do have smart boards, but I'll say there are not many because some of them it's either they are not working, or they don't have software or maybe teachers are not competent, or some things are stolen. Again, most of them are not, connected to the Wi-Fi. The only block that is connected to the Wi-Fi. So, if you go to the classes where ICT is really needed, there's no such plan* (P19F).

P20F (School D – Teacher) answered:

> *Yes, it's positive and good because it makes our life easier nowadays. When using technology learners are more interested to learn. The learners love technology. Again, technology helps you to clarify certain things that you would find difficult to explain on your own. For example, you can introduce your lesson with a video, and this can help learners understand the concept better* (P20F).

In School E, all the respondents concurred that ICTs were contributing positively at the school. They alluded to the fact that ICTs made the work of the teacher easier. Teachers can use audios, visuals and videos for their lessons. They argued that ICTs help learners understand things that are abstract better when teachers use visuals and videos since learners understand things that are concrete more easily. The respondents also highlighted that ICTs helped with administration, lesson planning, assessment and storage of work.

P21M (School E – Deputy Principal) said:

> *Definitely. It contributes positively and allows us to utilise many sources to improve the understanding of the concept. Sometimes there are certain concepts that are extremely difficult for learners to understand but with the use of a video clip, learners can understand better. Furthermore, you can give learners diagrams. This will help increase their understanding. So absolutely ICTs, have a positive influence* (P21M).

P22F (School E – HOD) indicated,

> *Yes, it is contributing positively. When we use smart boards, we no longer need textbook copies because you can project on the board. The kids also become more interactive because of the technology device. And as you know, the smart board has other features. So, ICTs have made it much easier for teachers to teach different classes because once you've done all of those on your notebook, you then save it to like a flash drive, and then you can take it to the next class. We don't have to rewrite everything for each class. So, ICTs have got considerable positive impacts* (P22F).

P23M (School E – Teacher) answered as follows:

> *I think it is best for us teachers it reduces considerable paperwork and if you have prepared a lesson for, let's say smart board. A smart board is much easier to use. This is also helpful if you have visual learners because they're able to then see what you are explaining. Learners also tend to be more attentive when you use these technologies. So, they are also participating more on those things and become more energetic* (P23M).

P24F (School E – Teacher) said:

> *Yes, it is contributing positively. I started using the smart board making slides using videos. I think they are very effective, very, very effective and they prompt the learners to engage into the classroom discussions* (P24F).

P25M (School E – Teacher) responded:

> *Yes, it is. With regard to the subjects that I'm teaching, it is much easier for learners to understand when they see teachers have videos especially geography report. When you teach geography to Grade 12 learners and you are explaining soil erosion, learners don't understand it without visuals. However, when you show learners, visuals using the smart board then it becomes easier for them to understand. So, ICTs are positively contributing to teaching and learning at our school* (P25M).

The findings from this study show that, out of 25 teachers who were asked if using ICTs contributed positively to their individual schools 23 (92%) agreed, while 2 (8%) disagreed. In the same vein, Chaudhari (2017:2) argued that the use of ICTs in education makes learning interesting and learners to be active in their learning, while Govender and Juggernath (2020:367) concur that they enhance teaching and learning. Furthermore, ICTs provide teachers with countless resources that bring more diverse teaching approaches to the classroom (Coman, Tiru, Meseșan-Schmitz, Stanciu & Bularca, 2020:3).

5.8.2.2 Assistance rendered by the Gauteng Department of Education

Assistance rendered by the GDE is the second theme that came from the second sub-question asked: What assistance are you getting from the GDE as a school on how to effectively use ICTs in the teaching and learning process? From the main theme, sub-themes also emerged. The theme also brought up sub-themes. This question sought to ascertain the amount of assistance the schools and teachers get from the GDE with regard to ICTs. The question was asked, and all five participants' responses were recorded and transcribed. From this main theme, two other sub-themes also emerged, namely, ICT training in schools and ICT hardware and software support in schools. The main theme and the sub-themes were all addressed by the participants when they gave their responses. The responses of the participants all the participants agreed that the GDE was trying hard to assist by making sure that teachers in school are trained on ICTs. They all concurred that the GDE was sending personnel to their schools to help with technical and software issues. The following are all the responses that were given that were given by the participants.

P01F (School A – Deputy Principal) said:

> *The Department of Education gave us much support and even sent a mentor to guide us during the week on things we don't understand. These mentors were also available as technicians, and they supported us with software and technical support* (P01F).

P02F (School A – HOD) gave the following response:

> *The department is very supportive and provides training. They see to it that teacher development in the district is assisting us as teachers. We constantly attend the training at our school* (P02F).

P03M (School A – Teacher) responded as follows:

> *They organise some tutors for us, like once a week, not sure if it's on Wednesdays. When they come, they help us and show us how to utilise the internet and how to use different features of ICT instruments. The tutors are from the Department of Education* (P03M).

P04M (School A – Teacher) said:

> *We are getting much support from the department. They provide workshops for us like on Wednesdays and Thursdays. We also have ICT champion who normally come to the school and teach us to how to use smart boards and how to connect them to the internet* (P04M).

P05F (School A – Teacher) explained:

> *Apart from providing us with laptops and smart boards, there's a person who comes every Wednesday to assist teachers on how to use these ICTs. However, I think the training that they're giving us is not adequate* (P05F).

The participants further explained that in some schools the support person came once a week and in some schools twice a week. Over and above, they said the GDE also provided workshops for teachers on ICT. However, most of the participants echoed that the time slots for the trainings were not convenient for most teachers because of commitments with other school-related work. They also said that the time of the training was not enough and suggested that more time be allocated to training sessions.

Participants in School B were also asked the same question in an effort to establish whether the GDE was supportive with regard to ICT use in the schools. In addition, the researcher wanted to know what type of assistance they were being given by the department. This was necessary since it helped the researcher to identify the gaps in terms of the support being rendered. The researcher could then suggest better ways of assisting the schools and teachers in their important mission of making sure that ICTs are effectively used with the sole aim of improving learner and teacher performance in their school.

P06M (School B – Deputy Principal) answered:

> *Quite frankly, they are supportive. They provide us with training for using the ICT instruments. People come in teach us how to operate smart boards according to our subjects. Bad, bad, bad implementation not happening* (P06M).

P07M (School B – HOD) replied:

> *All we do is getting regular training. There are different people who usually come on appointment to train teachers according to their needs. This could be maybe the type of*

skills the teacher might be might have asked for. Maybe if I need knowledge on how to download or upload information from this source to another source to make my preparation, I will be trained on that. So, we do get training (P07M).

P08M (School B – Teacher) reported:

They do workshops, but I feel like they're not effective. They are bringing people to teach us on how to use smart boards. Nothing else. It doesn't promote of ICT at all (P08M).

P09M (School B – Teacher) said:

They give us training on how to use these computers. We are trained from the people who come from the Department of Education (P09M).

P10M (School B – Teacher) responded:

The Department of Education is very supportive; it sent its team from the offices to come and train us on how to use computers (P10M).

In School C, two of the participants acknowledged that the GDE offers them some help while three of them indicated that they were not impressed by the kind of help they were getting. The three said the help was not enough and not really helping them. However, the other two participants were positive about the whole assistance thing from the department. In fact, they said much when asked this question. When the researcher asked the same question to this school, the aim was to establish the type of assistance this particular school was getting from the GDE paving way for future programmes and improvements. Their responses are given herewith below:

P11M (School C -Principal) answered:

We get in workshops. In these workshops they train us on how to use smart boards. It varies by subject. Other subject is convenient to users. They also show us how to use Smart board ports and how to turn them on. They also demonstrate how some functions are operated. So, I think I would say that department is providing us with help in terms of training (P11M).

P12M (School C – HOD) replied:

> *Since the implementation of the ICT in my school there has been continuous training of teachers within our schools. So, every week, we do have trainers from the Department of Education that come to assist teachers where they could be having challenges with ICTs. The training is helpful. However, I feel more could be done. However, from the Department of Education side, they are really trying their best. So, at the end of the day, it's up to the teacher to just take it forward* (P12M).

P13F (School C – Teacher) said:

> *The department tries its level best to assist us because they provide beginner trainings in ICT. Number two; there is always a school-based ICT technician who's here to help educators who are having difficulties in interacting with the ICT equipment. So, it's either it's before the school or at lunch or after school, the intern will be there to take you through the materials. And every now and then they come and collect the laptops and the likes to go and update them to put some antivirus. I think they are doing their level best* (P13F).

P14F (School C – Teacher) responded:

> *The Department of Education is sending ICT coordinators or trainers to come and assist us with smart boards and other ICT-related things we don't understand. They teach us where we lack knowledge. These trainings take place twice a week* (P14F).

P15F (School C – Teacher) answered:

> *They send people to train us on how to use ICT instruments like videos, laptops and overhead projectors. For instance, my subject is mostly practical, and the use of ICTs will be convenient* (P15F).

In response on whether ICTs were contributing positively to their school, not all teachers in School D agreed that ICTs were contributing positively in their school. Some teachers were sceptical about the whole GDE support. For example, the responses of P18F and P19F (School B) clearly showed that they were in doubt when it came to the support from the GDE. In fact, they did not see the support as being adequate. The following are their responses.

P18F (School D – Principal) said:

> *You know, I'm teaching Grade 8 maths. Now remember I encounter some challenges. So, I do believe that whatever that I'm going to answer I need to be honest. I really don't know how to use some of these ICT instruments and it's difficult to get help at our school. That's all I can say* (P18F).

P19F (School D – HOD) further stated:

> *The department is it really helping. I know someone comes on Monday to our school to give us mini trainings. We can't really say it's training because people who do not know how to use it, they still do not know after the training. But it's easier for us because we know what's going on in ICT, but the older teachers do not know anything. So, I'll say the department doesn't do enough in terms of training or assistance. It's not enough* (P19F).

Other three teachers were happy with help they were getting from the GDE. They even commended the GDE for sending staff to contact workshops and training teachers on ICT matters. Teachers at this school said they were trained on how to use smart boards and how to use certain applications on the smart board. They further revealed that this person who was sent by the GDE also assisted them when they experience any ICT-related problems while teaching. The following section focuses on the responses of the other three teachers to the question asked.

P16M (School D – Teacher) responded:

> *Well, there's. There's often considerable training organised by the department. The trainings range from orientation if the teachers are new users. There is also intermediate or sophisticated training for advanced ICT users. Most of the training given is to assist new ICT teachers to be good in the classroom. Sometimes there's a roll out on Microsoft applications things that you often use for teaching. As a school, we also have a support person who is allocated to the school and always on standby. They help with ICT challenges including software and hardware. For the laptops that we received from the department, whenever we have a challenge, we reach out to the person for help* (P16M).

P17M (School D – Teacher) said:

> *The department always organise workshops during the holidays. Last year there was a workshop during the holidays so that we get used to how these ICT instruments are working. In 2016. I think, some delegates from the department came to assist us in classes on how to teach using these ICT instruments* (P17M).

P20F (School D – Teacher) answered:

> *Yeah, in the first place, teachers are provided with the basic skills of using smart boards and laptops. Then there's further training, considerable training that teachers will undergo to prepare them on how to use these gadgets. So, someone from the department comes to train our teachers fortnightly* (P20F).

Although participants in School E acknowledged the assistance the GDE is offering to their school in the form of workshops to training on ICTs. They also pointed out that the training does not seem to be adequate. The argued that the GDE sends them a person once a week to assist with support, which is not enough. The respondents gave their responses, which are recorded next.

P21M (School E – Deputy Principal) responded:

> *Personally, I have not received any training regarding how to use smart boards or having a laptop that will assist in the process of teaching and learning. Most of the time, the smart boards are not even working. So, I don't know if that is the issue with the school or with the DBE as a whole* (P21M).

P22F (School E – HOD) answered:

> *Alright, so right now they deployed an ICT coordinator from their side, and this guy goes to schools, including ours. So, he comes on rotation once every week. And then what he does is that he has classes or sessions with teachers whether on a one-on-one basis with the teachers or group session. He comes every week. The only reason he's not here now is because of COVID-19* (P22F).

P23M (School E – Teacher) responded:

> *They normally conduct trainings and help if we are facing challenges in using the ICTs by showing us how to use ICTs effectively. Fortunately for myself, I learned that I don't have a problem, but I still need more information. I, however, attend the lessons to get more insight in the use of ICT instruments* (P23M).

P24F (School E – Teacher) answered:

> *So far, I haven't been here for six months. However, we've got people that came here and checked on us as the ICT department. So, there was a circular, not so long ago that came and asked us questions on how we could be assisted with the ICTs, what challenges we were facing and so forth. And, again, there is a teacher here who is also based at the school assisting us in return* (P24F).

P25M (School E – Teacher) said:

> *There's not enough assistance from the department because they take too long to fix any damages to the computer. With reference to notify the connection, sometimes very poor* (P25M).

Three of the participants were in one accord when they said the department sends a person who come and train teachers at the school. However, two of the respondents were not satisfied with the level of training that they were getting. They said they were not getting enough training to make sure that they had the right skills to operate these ICT instruments, especially the smart board. According to these two respondents, their ICT skills were very poor.

Overall, 24 (96%) participants confirmed that the GDE supported schools, while some felt that the support is not enough and 1 (4%) said he never received any support from the GDE. It is noteworthy that most participants acknowledged support from the GDE. This is consistent with Mhlanga and Moloi's (2020:9) observation that the outbreak of the COVID-19 pandemic pushed the DBE in South Africa to adopt ICT education in schools. It supported schools through the provision of laptops, training and technical support. The integration of ICTs into teaching and learning can only succeed if it is properly supported by all the stakeholders in the education system including the government (Machando & Chung, 2015; Nomnian & Arphattananon, 2018:51; Tigere, 2020:19).

5.8.2.3 Promotion of ICTs in schools

Promotion of ICTs in schools is the third theme with its sub-themes which are provision of ICT equipment and access to ICTs. The theme and sub-themes emanated from the sub-question that was asked during the interviews. The question that was posed to the participants was regarding the effort schools were making to promote effective use of ICTs in order to improve learner and teacher performance. The aim of the question was to gather information on how schools were promoting the effective use of ICTs in order to improve learner and teacher performance. The number of teachers who took part in this study as mentioned in the previous paragraphs was (N=25). The responses of the (N=25) teachers who took part in the interviews were recorded and later transcribed.

It was evident from the participants' responses that schools were unique in how they promoted the use of ICTs in their respective schools. Nevertheless, there were some similarities in some of their responses in that some of them concurred that encouraging teachers to use ICTs and attend workshops and trainings was key to promoting the effecting use of ICTs so that they can improve teacher and learner performance. Most participants reiterated the importance of capacitating teachers with ICT skills as one of the ways that will build teachers' confidence when using these ICTs in teaching. They argued that a teacher who is not confident in using ICTs can never use them optimally in the classroom. Rather the teachers who are not confident in using these ICTs will try and avoid using them and this can derail the whole issue of promoting the use of ICTs to improve teacher and learner performance in Soweto secondary schools. Below are the responses of all the teachers, school by school.

P01F (School A – Deputy Principal) had the following to say:

> *To improve teaching and learning, as a school, we do help each other. For example, if I have good ICT skills, I become an ICT champion and help train others. So, if a teacher says they're having a problem with something then we can stay behind with the teacher and show them how that is utilised. This will build their confidence when teaching in class. Again, if a person cannot use the smartphone, then we encourage using laptops because there's less touching* (P01F).

P02F (School A – HOD) answered:

> *At the moment, all teachers here in the school, were given teacher laptops. So, we use the teacher laptops for administration purposes. The teacher can also prepare lessons during their spare time. Teachers are free to use their laptops for teaching purposes. As teachers we are not at the same level when it comes to the use of computers, so the school makes sure that each teacher moves gradually, step by step at a pace that is comfortable to them. Teachers also have groups which are used to assist one another especially when it comes to the use of ICTs. The ICT coordinator makes sure that trainings are arranged according to teachers training needs. There is also training for beginner teachers to attend trainings which focus on training teachers on basic ICT skills* (P02F).

P03M (School A – Teacher) stated:

> *Teachers are being encouraged to submit most of their work using ICTs. Our school is also trying to modify our subjects' submissions; teachers are expected to be submitting trough teams. They are also to contact meetings via WhatsApp and use the same platform to convey any messages so that teachers come to school prepared* (P03M).

P04M (School A – Teacher) said:

> *The school is encouraging all teachers to be well vest in using ICT instruments. The school even has an ICT committee that is responsible in making sure that all the teachers' ICT needs are met. The ICT committee also do daily checks to see if all the ICT instruments in the school are functional. Again, internal in-service trainings at school level are organised to make sure that teachers are abreast with all latest ICT skills they need for the teaching and learning process* (P04M).

P05F (School A – Teacher) responded thus:

> *At the school level, teachers are given support on how to use ICT instruments by the school ICT committee. The committee is also responsible for making sure that all ICT-related instruments are functional and in order. Where necessary arrangement is made to make sure that support if needed is given when teachers are teaching in the classroom. Besides the trainings organised at school level, teachers are also encouraged to attend trainings that are organised by the district. This will help teachers to improve their ICT skills* (P05F).

The same question was posed to the participants in School B. The responses from three of the participants P08M, P09M and P10M were not that positive. They complained that not much was being done at their school to promote the use of ICTs. The other two participants agreed to some extent that something was being done to promote the use ICTs in their school. Their responses are recorded below.

P06M (School B – Deputy Principal) answered:

> *It is evident enough we are promoting the use of ICTs at the school because we organise people to come and train our teachers. We do this to make sure that the teachers are equipped and can handle those things. We've also had the department bringing in their own people and every time these people come, we then organise teachers just to make sure that they go through this training. The unfortunate part is that it normally takes place during the day when they are also busy with the teaching. So, there's very little space to take them through training. But we've got a functional ICT committee* (P06M).

P07M (School B – HOD) responded thus:

> *Yes, out teachers are encouraged to use computers and laptops for preparing their lesson plans. When they always use the laptops and computers, they gain considerable confidence in using them. However, most of our teachers are computer savvy, and they freely experiment and use these ICTs. These teachers freely connect and get to use ICTs* (P07M).

P08M (School B – Teacher) said:

> *They hardly promote the use of ICT so that can be effectively used to promote teaching and learning. Nothing's been done by the ICT committee. The committee is not functioning* (P08M).

P09M (School B – Teacher) answered:

> *Currently, we have a computer lab, but it's only limited to those learners who are doing computer literacy which is computer application and technology. Most of our learners don't really use computers, because of lack of access. We have Wi-Fi but it's only at a particular range, the radius is too small, so it is not connected to the whole vicinity. We do have some devices, but they have stolen most of the hard drives* (P09M).

P10M (School B – Teacher) stated:

> *They try to arrange some workshops for teachers, but I feel they are not doing enough. They should also beef up security so that devices are not stolen. Connectivity must also be beefed up so that we all have access to the internet* (P10M).

Surprisingly again, three participants in School C gave very negative responses about how the school is promoting ICTs. The three argued that the school's ICT instruments were not used optimally and only a few learners had access to the computers that the school currently have. They also pointed out that most teachers did not have the required skills to use these ICT instruments and that the training that being offered was not doing enough to promote the use of ICTs. Only two teachers responded positively and said that the school was doing well in terms of promoting the effective of ICTs and that the GDE was supportive by offering trainings on the use of these ICTs to the teachers. However, this is confusing because three teachers out of the five that were interviewed were negative about everything while only two teachers were positive about how the school was promoting the use of ICTs. The responses of the participants follow below.

P11M (School C – Principal) revealed:

> *They just allow you to use a smartphone. And then you have a pin in your smartphone. You're the only one who's reliable. That's the only way they get to do your job, nothing else. They don't provide you with any assistance in terms of technicalities and things despite the one that you get from the department trainings. Access to the Wi-Fi and things like that are not there. We are given laptops from the department and those laptops; we just use them to print* (P11M).

P12M (School C – HOD) answered:

> *I think we still have a challenge in promoting ICT. One of the reasons is the age variance in terms of ageing within my colleagues. You'll find that some of them they've been teaching for decades, they are left with about four years to exit the system. So, they are not interested in new languages, learning new technologies as they come. Those coming from universities have been using these technologies at university. When they come to schools, they are very expectant thinking schools will provide those technologies, only to find that now we don't have some of those enabling technologies. This becomes a challenge* (P12M).

P13F (School C – Teacher) stated:

> *Well, I think we are lacking in that area. You know, we are not doing enough to try to promote the use of ICT because even when the department has said that we must be paperless and stuff like that. You find out that in some instances where something could be done using ICT, you find that the school will still resort to using papers and stuff like that. Whereas one could just maybe quickly what's up a document that needs to be sent to the principal's office, but you still have that situation where whoever may be a leader will conspire with others to still use hardcopies. So, I think in that regard, we are still lacking a bit in terms of promoting ICT use within the school. However, I believe bit by bit we'll get there but we need to put more effort* (P13F).

P14F (School C – Teacher) answered:

> *Since now, learners are also using smartphones and that we don't have laptops at our school. We're encouraging them to use these smartphones by giving them research information where they need to go on Google using the school Wi-Fi the school which is made accessible to learners. By using their smartphones, they are cultured into using ICT for learning purposes* (P14F).

P15M (School B – Teacher) said:

> *We have been given laptops to connect to the Wi-Fi and the smart board. Okay. With the use of ICTs teaching and learning becomes easier for teachers. The use of the Wi-Fi and laptops in the school is promoting the use of ICTs in the teaching and learning process* (P15M).

The teachers' responses to the same question in School D also seem to suggest that not much was being done by the school to promote the use of ICTs except encouraging teachers to use smartphones for teaching and learning. Connectivity issues and access issues seem to be ranked top in hindering all efforts to promote the use of ICTs at the school. The participants' responses were recorded as follows:

P16M (School D – Principal) responded this way:

> *Well, as a school, the best I've seen is via the SMT integration and for staff to attend the trainings that are developed by department. Yeah, we also have other training apart from the person that I mentioned in the previous question who comes once a week* (P16M).

P17M (School D – HOD) answered:

> *We have an ICT committee that is ensuring that teachers are helped in all matters regarding ICTs. We have a coordinator for this committee. The committee is comprised of young people who are highly skilled in these technologies, so the school is benefiting and is doing great* (P17M).

Responding to the question, P18F (School D – Teacher) said:

> *I encourage learners to use their phones and tell them what to do. I also need to monitor what they are doing so that they don't play with their phones* (P18F).

P19F (School D – Teacher) shared:

> *As a school we have our groups we interact with learners. We also have an ICT committee, which run by our school ICT coordinator. The school also try its level best to organise trainings to encourage us educators to use our phones to interact with learners. They try but then the capacity and the resources are not enough* (P19F).

P20F (School D – Teacher) said the following:

> *The school does nothing. They don't even organise training for teachers internally. At times laptops do not connect to the internet and when you report to the principal, nothing is done. At times you find only one person connected and that's a big challenge* (P20F).

In School E, the participants talked about how they encouraged learners to use their smart phones as a drive to promote the use of ICTs at their school. They also mentioned that their school has an ICT committee that is responsible for running all ICT programmes at the school. The ICT team has a coordinator that run the committee. They commented on the sterling work that the ICT committee was doing. The respondents also acknowledged the effort that the SMT made in supporting the use of ICTs by arranging training workshops for the teachers at the school. All the respondents gave their views, which are recorded next.

P21M (School E – Deputy Principal) gave the following response:

> *Well, it's not very difficult having to convince the learners to adapt to you the use of smartphones and computers; it's much easier because they are born after technology. But for older teachers, it becomes very difficult to convince them as to the aim doing the teaching with the smart board and things like that. But as a school, I think there is there is a lab. And I once heard that there was training from, I don't know, through the training a lot on how to use smart boards and things like that. And there are also educators who receive laptops, but it's not all the indicators unfortunately* (P21M).

P22M (School E – HOD) indicated the following:

> *Yes, we do to a certain point. Currently our school has Wi-Fi for teachers and the learners. However, we need to make sure that when it comes to learners our control on how they use their cell phones is well controlled. The Wi-Fi, however, is only in a specific location so that they can use it during lunch time. So, I think to a certain degree, that's one of the things that we do to show our encouragement to using ICT and the internet. We have smart boards in every class except three Grade 9s and three Grade 8s. The smart boards are all working perfectly. In terms of back-up and software, we have someone to help us assigned by the Department of Education to our school. The person comes once every week if I am not mistaken. He comes in and do a check on how many of our ICT instruments are not working* (P22M).

P23F (School E – Teacher) said:

> *I can assure you that learners from Grade 10 to 12 all their classes have ICTs and smart boards. Yes, they are working we have whiteboards so actually it's optional. It's up to the educator if they wants to utilise a smart board for a specific lesson. In terms of Wi-Fi and connectivity, we do have Wi-Fi. For example, here in the staff room, we do have Wi-Fi that you can utilise to download anything from the internet* (P23F).

P24F (School E – Teacher) answered:

> *We encourage learners to use smartphones or laptops and teachers to use smart boards. Learners in most lessons they are not using their cell phones hence we encourage them. Learners also do not have laptops because of their poor backgrounds. We also encourage our learners to use the labs to do research even though in most cases they use their cell phones"* (P24F).

P25M (School E – Teacher) gave the following response:

> *Well, the resources we have are not enough. We only have smart boards but some of them are not working. So, we try by all means to make sure that we utilise the ones that we have and try to engage teachers on how to use these ICTs including videos, audios and pictures* (P25M).

At this school, the respondents acknowledged the fact that they had smart boards although some were not working. They also appreciated the fact that they had the internet at the school and that they could use it to download teaching and learning resources. However, they said that the resources were not enough, and some teachers were not eager to use these ICTs. Therefore, there was a need to encourage all these teachers to consistently use them. It was not only teachers who needed encouragement to use ICT instruments according to the respondents, but learners also needed to be encouraged to use their smart phones for educational purposes.

Out of 25 participants, 18 (72%) of the participants agreed that their schools tried hard to promote the use of ICTs by providing teachers with laptops, encouraging learners and teachers to use ICT tools, providing internet to schools and training. Similarly, Chisango (2019:330) affirms that teachers, school principals and the DBE should the use of ICTs in schools. Arends (2021:55) concurs that the HoDs in school can forge cooperation among teachers and promote teaching and learning.

In this study, 7 (28%) were negative about the promotion and use of ICTs in schools. While the number of teachers who said nothing was being done to promote the use of technology in schools was small, it was significant and concerning. Current research has revealed that schools in South Africa still complain about a lack of ICT support, a lack of training, a lack of infrastructure, connectivity problems and a lack of technological tools (Arends, 2021:140; Mfuphi, 2020:130; Ngobe, 2023:52; Nyathi, 2022:77), which impedes schools from effectively integrating technology in teaching and learning.

5.8.2.4 Challenges in using ICTs for teaching and learning processes

Challenges in using ICTs for teaching and learning is the fourth theme. It had three sub-themes which is connectivity, security of ICTs equipment and ICT skills. The main theme and its sub-themes emanated from the responses of the participants. The main theme and sub-themes came to light when the sub-question "What challenges do you have as a school in using ICTs for teaching and learning?" was posed to the participants. By asking this question, the researcher hoped to identify the challenges that teachers face when using ICTs in their schools. This was a very important question because when challenges are known then they can be that tackled. If not tackled, they could jeopardise the government's effort to promote the use of ICTs as a means of improving teacher and learner performance in schools in general. The responses of the participants are shown below from (n=25) participants and from (n=5) schools.

P01F (School A – Deputy Principal) answered:

> *The challenge we have usually is that not all classes have smart boards. For example, our Grade 8 and nine in the labs can't have the ICT that the other classes enjoy. So, when I must teach something, maybe I need the smartphone, then we should communicate with the other two teachers, to say, please lend me your class and then your learners can come to my class. So, that is one of the challenges that we have so far. At the beginning, the other challenge that we used to have in the classrooms is that when teachers left learners would play with the smart boards* (P01F).

P02F (School A – HOD) responded:

> *For now? I think the greatest challenge will be we are still in the entry level of ICT. I won't say we are already there, but we are still at the entry level one. I mean, the teacher can switch on the smart board; the teacher is able to open the smart notes. So, teachers are gradually improving. I think we still need to equip ourselves more with higher level ICT skills. I think we are still on the basic, which I think its fine because the roll outs have started in 2015. And then we are gradually improving* (P02F).

P02F further indicated that although teachers had all the technology at their disposal, they still did not use the learning platforms, software and ICT equipment in class for teaching and learning.

When you look at platforms like Google Classroom, that can be brought to class and Siyavula some of our teachers are not yet utilising them in class. As for me, I can freely say, I am there (P02F).

P03M (School A – Teacher) had the following to say:

I think the challenge is that the laptops they have given us you cannot put the disc on it. You can only use a USB, but the district sends you discs with information therefore you can't download the information on the discs. The laptops have considerable restrictions put on them, meaning there are certain things you cannot do. You need an admin password to operate certain things (P03M).

P04M (School A – Teacher) responded in the following manner:

I think we should also in our school system have ICT technicians especially when dealing with computers and ICT instruments. This is very important because when using ICTs, considerable things can go wrong. If something goes wrong and you do not know what to do or how to fix it, this can be very disruptive. For example, the computer or smart board can freeze while you busy with the lesson, and if there is no one to help the lesson will have been wasted (P04M).

P05F (School A – Teacher) said:

The challenge we have is that these boards and all these machines, sometimes they get stuck. So sometimes we get delays. We don't have technical support for the motherboard. That's the problem. We also don't have extra seats in the computer labs. The school need to have a school-based technical support person (P05F).

The responses given by the teachers touched on several challenges that the school was facing in terms of the use of ICTs. Almost all teachers bemoaned the lack of proper ICT skills by the teachers. They felt that although the teachers were being trained, the training was insufficient. Most teachers, according to the participants, did not even know how to use the smart boards and worse still, they could not use some of the applications that are on the smart board. This links with the sub-theme (c) "ICT training". The other issue that was raised was that the computers from the department had too many administrative controls like fire walls and no provision for devices on which to save work. This is directly linked to one of the sub-themes (b) "Security of ICT equipment". The participants perceived this as a huge hindrance to them when they want to teach learners in the classroom. They also mentioned that when dealing with ICT instruments like smart boards and computers, these instruments could be faulty at times and when that happened help was needed urgently. According to these teachers, more needed to be done to make sure there was ample support and help when such things happened. They suggested that a full-time school-based support person should be employed by the school. Teachers also complained about connectivity issues when it come to the learners (sub-theme (a) connectivity). According to the teachers, most learners cannot access the internet due to lack of Wi-Fi at the school. If they manage to connect, control over what they are watching on their cell phones can become a major problem because learners can visit unwanted sites if not properly monitored by the teacher. Other learners simply could not connect because they simply did not have cell phones and if they did, they also could not afford data. This challenge was raised by most of the teachers. Teachers also pointed out there was also a concern over vandalism of these ICT instruments by learners, meaning security was also another major problem at the school.

At School B, the researcher asked the same question in an attempt to determine the challenges that the school was also faced with when it came to ICT use. This was very important the identification of the challenges can lead to finding solutions. The responses of the participants in this school are provided below.

P06M (School B – Deputy Principal) revealed:

> *The challenge we have is that learners download other things that may not necessarily educational. You know, even in the afternoon you find these learners using their phones, but can we truly say that they're using it for the purpose is intended for? If you ask them, they will say, we are doing research. However, some of them are honest others may not necessarily be honest* (P06M).

P07M (School B – HOD) shared,

> *In terms of ICT access, if maybe we have access to Wi-Fi, then it means whatever device I'm holding, I'll be able to present a lesson maybe prepared from the internet. Maybe I would connect it to my data projector or some speakers if it's a video. But then Apart from that, you know, even if you can try any other means connectivity is the way to go. If you're not connected, you always resort to the old way of doing things* (P07M).

P08M (School B – Teacher) clarified,

> *In terms of English, I can't access the Wi-Fi. Therefore, I can't get information on the different methods of teaching certain topics. Most smart boards are not fixed so again, I don't even get to use my material in a lesson using the internet* (P08M).

P09M (School B – Teacher) indicated,

> *As it stands, as a teacher it's very difficult* (P09M).

P10M (School B – Teacher) reported,

> *Again, there are other things we can teach using ICTs, but because of the limitations that we are facing when it comes to connectivity, we are unable to use this ICT instruments* (P10M).

The respondents complained about many problems associated with the use of ICTs. All the respondents concurred that connectivity was a major issue. They could not connect to the Wi-Fi. Teachers argued that without connectivity, all ICT equipment and tools are rendered useless. They also complained about access and said that not every learner at the school had access to the ICT instruments. According to the teachers, this posed a huge challenge when it came to the use of ICTs in the teaching and learning process. Without access to the ICT instruments, one cannot use them, which defeats the whole purpose of using ICTs to improve learner and teacher performance. With regard to smart boards, the participants complained that not every teacher was fully equipped to use them, which created a big challenge during lessons. For instance, if they got stuck because they did not know how to use certain functions in the classroom, this would lead to time-wasting because the teacher would have to wait for assistance or support from other teachers or the school ICT support person. Furthermore, they complained about most of the smart boards not working and this meant teachers would have to scramble for the small number of the smart boards that were still working.

The same question was asked of teachers in School C. The responses of the participants in this school again pointed to connectivity as one of the major challenges they were facing. They complained of not having access to computers and that they had problems with Wi-Fi connectivity which was exacerbated by load shedding since the school was situated in an area that is prone to load shedding. Therefore, they could not always use their ICT instruments. Another issue that came up at this school was that teachers lacked ICT skills and needed more training. The training they receeived from the GDE according to them was inadequate. They also lamented the fact that when using ICTs learners need strict supervision because they can end up wasting time in class accessing sites that are not educational. Their responses to the question are given below.

P11M (School C – Principal) responded thus,

> *The main challenge is the Wi-Fi. The unavailability of Wi-Fi limits other avenues because we cannot use the internet. If there's no Wi-Fi, it means people are not using the internet, therefore they can't use ICTs effectively for the teaching and learning process* (P11M).

P11M further argued that, although the school had a policy around how cell phones can be used for teaching and learning, they found it hard to control what learners could or could not do with their cell phones.

> *The government is trying to promote the use of phones because it's one of the ICT components. Nevertheless, there is a policy at this the school that says no use of cell phones, which is a bit contradicting but maybe the school can see how the use of cell phones for the purposes of teaching and learning can be monitored. Learners can also use the cell phones outside school time* (P11M).

P12M (School C – HOD) answered as follows:

> *We don't have a major challenge in the use of ICTs. ICT is a lifelong process and you do not only use ICT for teaching purposes. When it comes to the learners, we don't have challenges, because they know more than us teachers. Most of them are very interested in computer-based learning and do their work. The only challenge we have with learners, is that of supervision. Especially when they are using ICTs. If you leave them alone maybe and say, guys, you can revisit this video and see the experiment; you'll find that when you go back, they've opened something else. Therefore, there should be proper supervision to gain more and effectively use ICTs* (P12M).

P13F (School C – Teacher) indicated,

> *We have the challenge of internet in the school, we don't have internet in the school. This affect us because there is work like research that learners needs to do. In preparation for assignments, learners and teachers might need to be online to prepare for their lessons. So, if there is no access to the internet, it becomes a challenge* (P13F).

P14F (School C – Teacher) revealed the following:

> *Sometimes you find that there's no electricity. Sometimes these smart ports are not working. Sometimes they take time to come in and repair these things. Sometimes having little knowledge on how most of the ICT instruments work could be a great hindrance to the teaching and learning process because of delays when someone is trying to master certain functions. Another issue could be data related challenges* (P14F).

P15F (School C – Teacher) gave the following answer:

> *We are in a location where most of the time there is no electricity. That's challenge number one. And then challenge number two, we get breakages. These are the few of the challenges that impact the smooth running of teaching of ICT at the school* (P15F).

To unpack and understand the challenges School D faced with the use of ICTs the researcher asked the question again: "What challenges do have as a school in using ICTs for teaching and learning?" The participants pointed out that it was difficult for teachers to get into meetings using ICTs because some teachers did not have the prerequisite ICT skills. Again, at this school the issue of connectivity and access was of great concern for most of the teachers. According to the teachers not everyone had access to computers and, if they managed to get access, they could face yet another challenge of connecting to the Wi-Fi. The school's Wi-Fi worked only in certain areas of the school. Another challenge that the school was facing was that teachers were not able to use smart boards and their features. So, teachers were not confident in operating smart boards in the classroom. Some teachers also took a long time to adapt to the use of the ICTs. On the learners' side, the teachers said that if they were not monitored properly in the classroom, learners accessed sites that were not educational and wasted learning time. The responses of the participants follow.

P16M (School D – Principal) had the following to say:

> *I think the challenge number one is adaptation of some of our members. You know, we've seen some of our members are very smooth. Added to this, when trainings are organised, you find that some of these members are not present. So, that's challenge number one. If people could attend the technology trainings workshops without cohesion, I think that will be easier* (P16M).

P16M further said:

> *In terms of software, we do have a challenge with software called Wi-Fi. Things only work better when connected to the internet hence Wi-Fi connectivity is key. The department has attempted to supply us with routers, but it was only 10 for a staff of 45* (P16M).

P17M (School D – HOD) stated:

> *We get training on how to use these ICTs. This helps to build teachers confidence. However, the process might be a bit slower because teachers grasp at different paces, others are learned faster and others slower. In terms of learners using their own personal gadgets we have a policy at the school that does not allow learners to bring phones because now it's against the police of the school. Cell phones have brought considerable problems before, so we are stopping them to bring their own personal phones* (P17M).

P18F (School D – Teacher) had the following to share:

> *The challenges we have are many and they differ. At times when we are having meetings using these ICTs, we fail to enter the meetings because we do not know how to do it. Some of the challenges are related to connectivity issues, laptops not working and lack of skills to operate these ICTs* (P18F).

P19F (School D – Teacher) added,

> *Challenge number one is resources; those hotspots are not serviced. Second hotspots are not serviced therefore they are not working. Some educators who have the smart boards do not know how to use them in class especially in maths classes. So, they have not been utilised and they end up being vandalised by learners because they see that the*

teacher doesn't use the smart board. The teachers who know how to use the smart boards are not allocated smart boards in their classes (P19F).

P20F (School D – Teacher) answered this way,

The first time when smart boards were installed, we were afraid to come school because we're not sure how to operate the smart boards. So, lack of ICT skills became a very big challenge for us (P20F).

From the information gathered in School E, almost all participants complained about the issue of access. They argued that many learners at the school did not have access to computers because they were in short supply. If all learners do not have access to the ICT instruments in this school, it means some learners are being left behind and this is of a great concern since the learners will lack ICT skills that are of great importance in the digital age. Furthermore, the interviews also revealed that participants were not happy with connectivity issues. They said that not everyone was able to connect to the school network and that was a big challenge especially for lesson delivery. Participants also brought up the issue of lack of ICT skills on the part of teachers and said that if teachers lacked the skills, it also affected lesson delivery and eventually affected the learners since they would be not getting quality lessons from the teacher. Another major concern that was raised was that of load shedding. They argued that their school had no back-up system when there was load shedding and this affected the whole teaching and learning process. The responses of the participants are given below.

P21M (School E – Deputy Principal) echoed the following in response:

Okay, let me say can I just refer to me personally, as I said before the maintenance is a challenge. So sometimes you prepare ahead for the lesson and to have slides on the right and then when you get to class, the smart board is not working. It becomes a challenge. Electricity is also a problem. So, we have a problem with load shedding. When it comes to the learners, I don't know if it's just me, but I feel like I lose them when I use the smart board most of the time. So, it depends on the strategy. So, it's more about knowing when to use a video, for example, and when not to use a video (P21M).

P22F (School E – HOD) said the following:

Well obviously, as load shedding is a big challenge. I think, even though we've tried so many times to remediate, our biggest challenges are the safety. The same community

> *that we as trying to assist is the same people who then break in and steal our ICTs. I think that's another concern the whole safety issue around these ICTs, and load shedding* (P22F).

P23M (School E – Teacher) responded as follows:

> *Unfortunately, we experience load shedding then it is a disadvantage because now I can't present lessons prepared on the Smart board. Another challenge is of controlling the learners when they are using their cell phones because learners can get up to mischief with cell phones* (P23M).

P24F (School E – Teacher) gave the following response:

> *I would say most of the learners don't have the access to ICTs other than here at the school. However, not every learner at school level has access to computers even though we have a computer lab because learners are so many. So, we struggle to operate like to get them all to do the work simultaneously* (P24F).

P25M (School E – Teacher) also said the following:

> *Okay, so one of the most important things that you need to consider is the fact that most of our learners are not familiar with ICT, so it becomes a problem now when you want to implement these things. Learners must be taught how to utilise these things. Teachers lack confidence on how to use the ICTs. Therefore, teachers need to be trained on how to use ICTs* (P25M).

All 25 participants from five schools provided similar responses about factors impeding effective integration of ICTs, notably a lack of training, connectivity challenges, a lack of infrastructure, a lack of teacher confidence and a lack of technological tools. These are consistent with the findings of Faturoti (2022:84), Makaring (2023:53), Ngobe (2023:52) and Nyathi (2022:77).

5.8.2.5 Mitigation measures

Mitigation measures is the fifth major theme with two sub-themes which are in-service training and ICT back-up systems and security measures. The theme and the sub-themes ensued from the question that was asked by the researcher to establish how the school deals with challenges that might arise at the school when teachers are using ICTs instruments. This was a very important question because if measures are not put in place to mitigate challenges that may arise, this could prove disastrous for the school and the teaching and learning process. The themes and sub-themes were touched upon in the responses of the participants. In his response, P01F's main emphasis was on teacher development, that is getting trained on ICTs. P02F also touched on teacher development but further mentioned the need for ICT security measures to prevent learners from accessing non-educational sites. P03M focused on preparedness and testing of ICT equipment prior to lesson presentation. P04M did not actually explain how mitigation is done at the school but rather argued that it is the teachers' responsibility to upgrade themselves when it comes to ICT skills. However, P05F agreed with the other three participants in that teachers are offered the opportunity to develop themselves by attending ICT training workshops provided by the GDE. The participants' responses when they were asked the sub-question "How do you mitigate/manage ICT challenges as school?" are given below.

P01F (School A – Deputy Principal) responded this way,

> *Well, at our school, we make sure that every Wednesday; teachers attend ICT development workshops provided by the district. The district deploys some of the experts as trainers and every Wednesday they are here. They sit with us and address areas of concern and teach us new skills* (P01F).

P02F (School A – HOD) responded as follows:

> *As for making sure that learners do not go to sights that are not allowed on their phones during lessons, the school will employ the services of an ICT expert who will block some of the social sites. They will only leave educational sites. To equip teachers with ICT skills, it will be advisable that all teachers attend all workshops that are ICT-based be it at school level or district level* (P02F).

P03M (School A – Teacher) had the following to say:

> *In terms of management needs, we always make sure we prepare our lessons prior before the actual teaching in the classroom. We also make sure we test whatever we are going to use prior to the lesson to make sure everything is working properly. This will help in making sure that the hiccups are minimised during the lesson* (P03M).

P04M (School A – Teacher) stated:

> *Most of the times, it's much on your efforts. You must know how to operate these ICT instruments. It's your responsibility as a teacher to seek help on the things that you do not understand. We must stop complaining and become problem solvers* (P04M).

P05F (School A – Teacher) responded thus,

> *The principal told teachers at our school to make sure that they attend ICT training workshops provided for by the Department of Education so the capacitate themselves with the necessary ICT skills* (P05F).

In School B, the teachers who took part in the interviews had different views. The researcher wanted to know how this particular school mitigated the challenges that they were facing regarding the use of ICTs. Some declared that there was nothing that could be done while others explained measures that the school could take to mitigate the challenges. Among their views, they cited encouraging teachers to attend workshops on ICTs and improving connectivity at the school. On the issue of the internet security, it was revealed that the school changes passwords all the time to try and control internet use by learners. The fear was that learners use the internet to access some sites that are not educational. When it comes to support for teachers, they said the school could not employ a full-time support person due to financial constraints but they were working on raising funds so that they could employ that full-time support person. Employing a full-time ICT support person would certainly be of assistance to teachers experiencing challenges using ICTs. The participants gave their views, which are provided next.

P06M (School B – Deputy Principal) gave the following response:

> *Hey, it's difficult, I must say, because also shutting the internet down would not be to our best interest. For now, we only rely on our own security for connectivity. We just rotate the passwords and change them because sometimes they do get compromised* (P06M).

P07M (School B – HOD) responded as follows:

> *We are planning that in the future we should raise some funds and ensure that we get somebody who can be a technical support person at the school* (P07M).

P08M (School B – Teacher) stated:

> *There's nothing we can do as teachers. We do communicate the problem, but nothing has been done. There's nothing we can do. I don't think the school reports such matters to the department* (P08M).

P09M (School B – Teacher) expressed the following view:

> *We can only make sure that we encourage teachers to attend workshops on ICT training. The school can also make sure that the school has a sound cell phone policy so that learners are properly monitored to prevent them from accessing unwanted sites* (P09M).

P10M (School B – Teacher) said:

> *I use my own data if I want to access the internet or anything like that. I make my own ways* (P10M).

In School C, the researcher needed to know how mitigation of ICT-related challenges is done. However, the main issue with this school according to the responses of P11M, P12M and P13F was connectivity. The participants said currently at their school they did not have Wi-Fi. One of the participants even mentioned that the main challenge they faced to resolve the connection problem was getting the school governing body (SGB) of the school to allocate the funds for Wi-Fi installation. However, P14F and P15F did not actually give mitigation measures; instead, they mentioned challenges. On the positive side, participants lauded the fact that, at the school, they had an ICT committee which helped to resolve ICT-related challenges that the school might face. Below are the responses of the participants.

P11M (School C – Principal) stated:

> *There is an ICT committee in the school; the ICT committee enforces or rather facilitates the use of ICT. The committee also promotes the use of ICT in the school. In a case where you have challenged the committee also helps. The committee also makes sure that the Wi-Fi is in place. They also decide which Wi-Fi should be used, what should be bought and so on. But obviously what creates getting all these things to be approved by the SGB who must see if the finances are available* (P11M).

P12M (School C – HOD) answered:

> *Currently, it's much easier because like I said: we don't have internet or Wi-Fi of some sort. This means that the content is only on the smart board. As a teacher, you can be able to manage your content by putting in something like password to limit learners from accessing your work. Perhaps we need to come up with some mechanisms on how to control this but for now, it is not a big deal* (P12M).

P13F (School C – Teacher) responded this way,

> *Well, there has been an attempt to try to resolve that. But the challenge to that has been, the delay in terms of getting some cheques signed. We've been trying to get the SGB to help us get somebody to come and install this Wi-Fi so that at least teachers, everybody, you know, can have access to internet when they are within the school. Currently I'm just from the office of the principal to submit some other quotations for approval. But as we have submitted, you might find that it might take, I don't know how long, and you will just be waiting and waiting* (P13F).

P14F (School C – Teacher) replied as follows:

> *We outsource. We also ask the facilitators from the district who are dealing with ICT. They come and assist us, and the neighbouring schools also come and assist us where we're have problems* (P14F).

P15F (School C – Teacher) echoed similar sentiments thus,

> *We are not having the Wi-Fi, so it is very difficult for us to connect to the internet. Again, the training that we are currently getting is not enough and more can be done to assist teachers when it comes to the use of ICTs* (P15F).

The researcher also wanted to know how School D deals and manage ICT challenges. To understand the mitigation measures, the researcher had to ask the same question that was asked to the other schools on how ICT-related challenges are mitigated. In their Reponses, the participants pointed out that the best that can be done at the school is to encourage teachers to attend workshops arranged by the Department of Education to close the skills shortage gap. This will improve their ICT skills. Furthermore, the participants said at their school they make sure they test all the ICT instruments before they use them to avoid an embarrassment in the classroom when teaching. They also reiterated that the school has resolved to open groups for the learners like WhatsApp groups for the purposes of teaching and learning. One other mitigation measure to curb internet connection challenges was that the school had made a commitment to improve the Wi-Fi at the school. To mitigate the challenges of load shedding P17 suggested the use of generators and whiteboards as a back-up when there is no electricity. The participants' responses follow below.

P16M (School D – Principal) responded:

> *We are observing other schools and how they do it, because one thing is becoming clear that you know, these things are here to stay. If 90% of learners have access to cell phone, then what is stopping us from using them in schools. We also check how they're doing with regard to their ICT policies and on Wi-Fi challenges* (P16M).

P17F (School D – HOD) shared,

> *We're getting considerable assistance from the Department of Education. We also liaise with other schools that are doing within ICT. As I mentioned, you know, our committee has got young and vibrant people, educators who are very keen and passionate about ICT so that means a lot. With the Wi-Fi, not all areas in the school have connection. People have made the request that you know, we need to provide it and we are in the process. It's under pipeline to ensure that learners also access the Wi-Fi, wherever they're at within the school premises. Yeah, it's not a problem. We are working on it together with the SGB* (P17F).

P18M (Teacher – Teacher) stated:

> *When we have meetings using ICT platforms, we should test to make sure that everything is working first before the meeting starts* (P18M).

P19F (School D teacher – Teacher) responded:

> *As a school I would say I don't know how to put it, because we only use our phones. We do not use the smart boards and only few teachers do. I know. I think it's one or three teachers that will use smart boards for maths work only. So as a school they try and the coordinator tries to engage educators, but it's not enough* (P19F).

P20M (School D Teacher – Teacher) said the following:

> *We encourage teachers to attend the department as I said to you earlier, workshop assist because they improve our ICT skills* (P20M).

In School E, the respondents argued that at the school some teachers had resorted to recording their lessons and then teaching them later when conditions allowed. For instance, if there was load shedding, they could teach the lessons later if everything was recorded. Still talking about recording, the teachers said they could also record and store their information on the smart boards for later use and this made their work much easier. Another thing that they brought up was that teachers had also resolved to help each other when they were facing challenges. This meant that teachers with better ICT skills would assist those who were struggling. Most importantly, the respondents argued that teachers and learners at their school needed to be encouraged all the time to use ICTs, as this would help improve their ICT skills. To mitigate the issue of load shedding, the participants said that the school was also considering installing generators.

P21M (School D – Deputy Principal) gave the following response:

> *I think you need to be strategical, know which topics you need to teach using the smart board and the topics that you feel you can teach without the use of ICTs. I think if you do that it will help you not to lose them during the lesson because you tend to lose them when using these ICTs* (P21M).

P22F (School D – HOD) answered:

> *We try to make sure nothing gets broken. At present we have more learners and very little computers. Now we are in lockdown we would want our learners to have access to these ICTs. Even if the learners come to school there are not enough computers to use. We are also considering having generators, but the only issue is finances. So, the alternative is to use the whiteboard. So, in every class we have a whiteboard so that when there is no electricity, we have something to use* (P22F).

P23M (School D – Teacher) said the following:

> *What we do is we rely on data and whiteboards so the lesson can later be presented to learners. I must make sure I have copies in advance just in case on that specific day I experience a little challenge. So, we normally make use of whiteboards as a precaution as well as copies* (P23M).

P24F (School D – Teacher) responded:

> *Speaking for myself, I use videos when teaching and then and then after a few minutes I pause and just get feedback from the learners asking them what they have learned. Then I'll continue, just playing the whole thing at once because you lose them in the process* (P24F).

P25M (School D – Teacher) had the following to say:

> *If one teacher needs assistance with maybe operating a smart board, how to use some functions, how to how to make slides, how to attach videos under and how to play sound and videos we arrange for workshops for teachers. When mitigating the problem of learners, it's easy. It's easy because you just make sure that you familiarise them with whatever material that you have* (P25M).

To overcome the challenges mentioned above, all 25 participants said teachers should attend training workshops, and that there was a need for cyber security sensitisation and an overhaul of ICT policies in schools to allow learners to use their cell phones. They said these would encourage learners and teachers to use ICTs in learning and teaching, solve connectivity issues and a shortage of technological tools, and enable schools to form functional ICT committees. Only one participant mentioned that in the school, nothing was being done to mitigate challenges. These suggestions are consistent with Chisango's (2019:325) recommendation that all stakeholders in the education system should mitigate challenges such as a lack of training, connectivity issues, a lack of technical support issues and a lack of skills. Arends (2021:1460) concurs that the school management and other stakeholders should make sure that any challenges pertaining to the use of ICTs in schools were eradicated.

5.8.2.6 Recommendations and suggestions

Recommendations and suggestions are the sixth theme that emanated from the study. It had two sub-themes which are in-service training and ICT back-up and security. The themes emerged when the participants were asked the sixth sub-question of the study "What more can be done at your school to make sure that ICTs are effectively used in the teaching and learning process in order to improve learner and teacher performance?" The question was asked to gather information on what more teachers were doing at the school with regard to the use of ICTs with the sole aim of improving learner and teacher performance. Participants made some recommendations and suggestions on what schools could do to improve the effectiveness of

ICTs in their respective schools. From the responses by the participants, it seems that most of the participants agreed that there was need for more in-service training. They reiterated the importance of teachers beefing up their ICT skills so that they could deliver effective lessons in the classroom. Participants argued that some teachers were still sceptical of using ICTs thinking these instruments were hard to use. Therefore, the only way they could discover that they were easy to use was by teaching them how to use them. When the teachers eventually discovered that the ICT instruments were user friendly, they would become more interested in using these ICT instruments.

Participants also pointed out that it was the duty of the school management to make sure that teachers were encouraged to attend workshops that had to do with ICT training. They also pointed out that it was the teacher's responsibility to make sure that they also availed themselves for such training. Key in their responses was that teachers needed to have self-motivation to learn more about ICTs. In other words, the motivation must be intrinsic, meaning it must come from within. What was also underscored was that schools need to employ full-time ICT support persons to help with both technical and software issues. Some teachers also suggested that a strong ICT policy needed to be put in place in schools to help enforce acceptable ICT use at schools. On the issue of laptops that did not have CD slots, the teachers suggested that they use USBs to save work from the hard drive for later use in the class. Additionally, the use of Bluetooth and Share-it may come handy. The following responses were given by the teachers:

P01F (School A – Deputy Principal) said the following:

> *I think what will be most efficient is that we even train our learners how to give reports using ICT instruments and move away from the traditional way of writing everything on paper using a pen. Teachers must be encouraged to type all their meeting minutes. They must save their information in folders that they create on the desktop. This will help improve teacher efficiency and performance* (P01F).

P01F further alluded,

> *However, some teachers the moment they hear that they will be using these ICT instruments they might be sceptical at first thinking these instruments are hard to use. But the moment they are taught to use them and discover that the ICT instruments are user friendly they become more interested in using these ICT instruments* (P01F).

P02F (School A – HOD) responded:

> *As teachers we don't need to fear this technology. But we are kind of like trying to say, let me research more as a teacher, as I am also a part of this vehicle that needs to move. So, I need to equip myself. Continue to study, do research and then also try to meet with other people in different schools, find out what they are doing, try to copy the good activities that they are doing, and then we should bring it back to our school* (P02F).

P03M (School A – Teacher) stated:

> *For me I think that teachers should get involved in ICT workshops. This is important because sometimes you will never know the importance of something if someone never tells you about it. So, I think the important part here is to ensure that teachers are always informed of all new developments and new ways of teaching using technology* (P03M).

P04M (School A – Teacher) echoed the following:

> *Teachers need to attend these workshops because sometimes we have more actions outside of the scope. So sometimes if we can pull out and go to this workshop, I think it can be that new beginning for teachers. The only concern is that sometimes where these trainings are done is far from our station. However, participating in these workshops is key for teachers as the workshops help them gain knowledge on the use of ICTs* (P04M).

P05F (School A – Teacher) replied as follows:

> *I think if we need to prepare on time, so that we know what we need before the lesson. For example, I teach science and sometimes I need to use simulations. It is also important to make sure you are familiar to all your tools before the lesson to avoid any delays during the lesson* (P05F).

In School B, the question was posed to find out what more teachers could do to make sure that ICTs are effectively used at the school in teaching and learning process to improve learner and teacher performance. From this information, the researcher could derive feasible ideas of what more teachers could do to make sure that ICTs were used for their intended purpose of improving learner and teacher performance. However, in their responses, teachers unanimously concurred that there was need to solve the issues of access and connectivity to promote effective use of ICT in the school. They argued that it was of no use to have ICTs at the school and yet not all could access them. Some of the teachers alluded to the fact that they needed to use optimally all the resources at hand. Training of teachers on ICT matters was echoed by most teachers. It also seems the teachers were not happy because they did not own classes. Owning classes refers to having a classroom a particular teacher uses for teaching all her learners. Teachers were against moving from classroom to classroom and suggested that they stay in one classroom with the learners doing the movements. The reason behind this was that learners could get up to mischief and play with these ICT instruments the minute the teacher left the classroom. It was also suggested that the schools put a very strong ICT policy in place to curb the challenges associated with learners using cell phones in the classroom. Teachers' responses are given below:

P06M (School B – Deputy Principal) responded this way,

> *Now cell phones are presenting another problem because during lessons learners can use cell phones and it can be disruptive. We debated this connectivity problem, but we could not reach an agreement. Finally, the governors of the school then decided maybe the best way after much debate is to stop cell phone use in class. They said when an educator wants to use cell phones in class, then they will notify management so that we have it controlled and restricted to a particular class. But it's not as effective as one would wish it to be* (P06M).

P07M (School B – HOD) said the following:

> *Anything we can do is use the material that is available to us which is textbooks and that's it. If this group is comfortable with using ICT, we don't mind we did good lessons. Last year, we used artificial, and smart working for ICT* (P07M).

P08M (School B – Teacher) revealed the following:

> *We need to start doing things with our hands, and the only way our mind can get used to operating these devices. So maybe access is number one and maybe if they can fix the problem that we have then this will help a lot* (P08M).

P09M (School B – Teacher) answered this way,

> *The thing is, sometimes teachers are the ones who are rotating and sometimes they are the ones that we keep complaining about connectivity. We have been having problems with the ICT, but nothing has been done* (P09M).

P10M (School B – Teacher) expressed the following view:

> *Teachers at our school need to be encouraged to attend ICT workshops. The school also need a strong ICT policy that regulates the use of ICTs in the classroom to curb any challenges associated with the use of these ICTs. For example, the policy must be clear on how learners use cell phones for teaching and learning in the classroom* (P10M).

To gather enough information on what more the teachers could do to promote the use of ICTs in School C, sub-question 6 was asked again in this school. All participants in this school concurred that teachers' willingness to upgrade themselves through the attendance of workshops was key to ensuring that they improved their ICT skills. The participants reiterated the importance of teachers turning to various ICT platforms to teach their learners. They suggested the use of platforms like WhatsApp, Zoom, Teams and Google Classroom, especially during the COVID-19 period. They observed that the learning should not stop because of the pandemic. Teachers should still interface with learners through the suggested ICT platforms. Thus, what is key is to keep encouraging teachers and learners to use ICTs in the classroom and at home. The responses of the participants are recorded below.

P11M (School C – Principal) responded this way,

> *It will be good if all teachers use smart boards. Smart boards are also like computers and teachers have personal computers at home. I also think the school must encourage learners to constantly use phones and computers and connect to the school Wi-Fi. Yes, I think that's the only way because we cannot use them without data or the internet* (P11M).

P12M (School C – HOD) said the following:

> *I think the starting point is to view ICT as an enabler in teaching and learning and it's not about Learners it's about us as educators; we need to familiarise ourselves with ICT to the extent that we feel much more comfortable. You cannot be comfortable before*

learners if you are going to use something or a tool that you are not used to. All we need is workshops and learn how to use the tools for teaching and learning. If you reach that level, then I think that's where we'll see the results (P12M).

P12M said it is impotant for teachers to an initiative in upgrading their ICT skills as follows:

It is best that every now and then if there is a workshop on ICT, see to it that you attend the workshops. On your own you must also teach yourself, because one of the modules that we do as teachers is that teaching is a lifelong process. So, these technologies, they will keep on coming. Today, you might be talking about WhatsApp, tomorrow, Zoom, two years to come, they will be something else. So, the only solution is to be prepared and learn (P12M).

P13F (School C – Teacher) echoed this way:

Well, I believe it starts with the willing power and personal to growth as a person and individually as a teacher rather. So, I think we need to teach ourselves how we need to take that first step. They must have that willingness to say Look, I've been given the training, let me give it a try, right? Instead of me going to the class and deliver my lesson, the traditional way, let me today, you know, use my laptop, and let me use the smart board (P13F).

P14F (School – Teacher) responded:

Above all, if it's just workshops without using the actual computers it will be a waste of time. In some cases, you will find out that some laptops that the teachers were given they are not working. But if this can be more improved modernised, these gadgets or the laptops that are given to teachers can be used for the benefit of the teaching and learning process (P14F).

P14F also suggested,

Teachers must also have access to the Wi-Fi. The use of computers can also be made compulsory and encourage that the old school the old school must use ICTs, this will force everyone to learn and study and use them in the classroom (P14F).

P15M (School – Teacher) suggested,

> *We need to encourage teachers and learners to use ICTs because it now the way to go since now the country was put under so much pressure because of the COVID-19 pandemic. This needed teachers to teach learners at home. Now teachers had to use WhatsApp, zoom and teams to teach learners and if teachers were not trained on how to use these instruments it could a very big challenge* (P15M).

For the researcher to understand more on what the teachers at the school could do to ensure that ICTs were effectively used for the purposes of teaching and learning to improve learners and teacher performance, he interviewed five participants in School D. Most participants agreed that teachers need to be motivated first on the use of ICTs for them to take the initiative to know more about ICTs. In other words, teachers are the ones that must take their skills-development seriously. One participant also advocated for collaboration between teachers. The participants also acknowledged that the country was experiencing a deadly pandemic COVID-19, which prevented the use of traditional teaching methods in the classroom. It was apparent that teachers needed a paradigm shift by acquiring ICT skills since lessons were now being done virtually. The fact that learners were not coming to school did not mean that the education of those learners must come to a halt. Instead, teachers need to continue to teach these learners even if they were at home; hence, the need for them to be more aware of the ICT platforms that they could use to continue teaching these learners.

The participants also mentioned that the school need to liaise more with the donor community and make communities realise the importance of these ICTs. The reason for this is that many children came from poor backgrounds, and they could not afford cell phones or data. When using these ICTs, teachers also needed to be innovative and creative to make sure that lessons were as lively as possible. They could do this by introducing videos and other visuals to the lessons to cater for all types of learners in the classroom. This is important because some learners are visual learners and they understand concepts more when visuals are included in the lesson. The responses of all the participants in School D are given below.

P16M (School D – Principal) answered as follows:

> *I think collaboration is important. If you were to begin to collaborate on what one is doing and how you're doing it. This will help foster that attitude to be able to try new things. This is true because basically, these things continue to be improved and*

updated. So, there is need for a constant capacity building training. COVID-19 has revealed us when it comes to the use of ICTs because very few people are not keen to use these ICTs (P16M).

P16 added,

We, however, still need more training because you still find teachers saying, I don't really know how to use the software and I don't know how to use Zoom (P16M).

P17M (School D – HOD) replied:

It's all about also self-development in an accepting and adapting to these new changes? I think that is very key. I am saying so because teachers need to have some commitment and the importance of lifelong learning and that someone must be willing to learn new things. Education is dynamics meaning it changes all the time. That is our job, we need to keep adapting to change. Okay (P17M).

P18F (School D – Teacher) said the following:

Teachers need to be motivated first to use the ICTs. How do I promote and get learners to be motivated if me as a teacher I am no motivated? So, firstly as a teacher, I need to give support and show the direction to my learners when it comes to the use of ICTs. If you as a teacher get motivated learners will too. For example, now there is COVID-19 and learners learn from home. Now this the time us as teachers need to embrace ICTs like never before (P18F).

P19M (School D – Teacher) gave the following answer:

Teachers need to be motivated, because some people are not interested at all, but they occupy those smart board classes. What would be the reason for them to be in those classes if they do not use them? One reason for sure would be that they do not know how to these ICTs and as a result they lack interest. If teachers do not know how to use certain ICT instruments, their confidence in using those instruments is severely affected and rather stay away. If they are interested, then they are motivated. Therefore, we need to keep pushing and motivating teachers to use ICTs (P19M).

P20M (School D – Teacher) responded as follows:

> *Teachers need to attend workshops whenever they are availed. This is the only way to master the use of ICTs in our schools. So now there is COVID-19, and it is demanding us to make use of ICTs. That's where everything is going in this world. They talk about the fourth industrial revolution and the MEC for education is pushing for paperless schools. Everyone needs to start using ICTs* (P20M).

For the researcher to know how teachers at the school D were promoting the use of ICTs five participants were interviewed. All the participants concurred that one of the things that the school could do to make sure that teacher do more in terms of ICTs was to keep encouraging teachers to attend workshops on ICT. According to the participants, if teachers attended ICT workshops, it would help them improve their ICTs skills. If teachers' ICT skills were improved, their confidence in handling ICT instruments like smart boards would also increase. The participants said the current situation in the country of COVID-19 left teachers with no choice but teach virtually. Therefore, there was a need for teachers to embrace ICTs and to upgrade their ICT skills. Teachers need to know how to use all available ICT platforms to teach the learners. These platforms include Teams, Zoom and WhatsApp, just to mention a few. The responses from all five participants are recorded below.

P21M (School E – Principal) responded this way:

> *I think the department must train educators. They should conduct workshops and training. Teachers must be shown how ICT simplifies the teaching and learning process and how it will improve the education of the school and so forth. Teachers must be given proper strategies as to what to do and how to use smart boards and when to use them. We now have COVID-19, and we are all talking about here ICTs* (P21M).

P22F (School E – HOD) said the following:

> *I think it's an integration thing. To be honest, I feel this is a very crucial time in the education sector. In class you've got an hour to present your lesson, and in that one hour you should make sure that everything works out. So, I think it doesn't necessarily give us enough time to experiment with the kids when it comes to other tools or devices that might benefit the lesson. There is no way you could have maybe a quiz of some sorts, you know what I mean? An interactive quiz. So not to take up too much of your time. I think one of the things we can try to do better is just finding other ways, tools,*

> *mechanisms and software that can be integrated to make learning more interactive. As for the learners and teachers, I feel right now even though we are using technology, we haven't really moved away from the basic methodology of teaching, but we still rely on using the textbook, we project the textbook on the screen, you know and things like that. So, I think just integrating more tools into learning that might be helpful* (P22F).

P23M (School E – Teacher) gave the following response:

> *I think as educators with regard to this type of sophisticated materials, we just need to make sure we practice so that we will be familiar with the connection and it's not that complicated. It's a matter of connecting cables connecting into a PC or the government PC and then boom, you can proceed to the lesson* (P23M).

P23M further highlighted socioeconomic factors as one of the challenges township schools faces. The participant is of a view that more has to be done to support township schools with ICTs. According to the participant, the government needed to do more in townships schools so that they could not lag behind with technology. Below is what the participant said:

> *Township schools are not as privileged like former group C schools. Former model C schools have resources unlike us in the township who rely or depend on the Department of Education. Even if resources are given another challenge that schools could get is that of connectivity, access to the data. Some learners can't afford data meaning when they get home they can't connect to the internet. Therefore, government should support township schools more when it comes to ICTs* (P23M).

P24F (School E – Teacher) gave the following answer:

> *I think if most of us can adapt to teaching and learning using ICT that will help a lot. Right now, you will find that a few of the teachers are using ICTs. You'd also find that in a school like ours, it's only one or two of the teachers that are using the ICTs. And in most cases, teachers are not confident enough because they lack certain ICT skills. It will be only those teachers who have been trained that will be confident in using the ICT instruments. Therefore, teachers need more training on these ICTs for them to gain confidence in using them* (P24F).

P25M (School E – Teacher) revealed the following:

> *It's the duty of the department to say, okay, can we do research on how many teachers is able to teach using ICT? And then we'll take it from there. The research will help them identify how many teachers that cannot use these resources, how the teachers can be assisted and how many teachers are at least knowledgeable about ICTs. This is very important because it will be hard for other teachers to assist since they will be also busy with their own classes. Teachers also need to have that drive to learn and acquire ICT skills because if the zeal is not there, nothing will work. They also need to to put an effort towards upgrading themselves* (P25M).

These recommendations are consistent with those made by Faturoti (2022:9), Nyathi (2022:79) and Ngobe (2023:75) that the government, school management, school governing bodies, NGOs and other stakeholders in education should promote the use of ICTs in schools.

5.9 CHAPTER SUMMARY

The aim of this chapter was to present the findings of the data gathered from the questionnaires that were filled in by both learners and teachers together with interviews that were conducted with teachers, principals and HoDs. The purpose was to establish whether the issue of using ICTs in these selected five schools was contributing to improvements in performance for both learners and teachers. The first analysis comprised completed questionnaires on the phenomenon of ICTs use in the schooling system. From the targeted 100 learners, only 85 learners completed the questionnaires and from the targeted 50 teachers, only 46 teachers completed the questionnaires. The questionnaires were analysed quantitatively. The second section was interviews with principals/deputy principals, HoDs and teachers from the five selected schools. From each school, a principal/deputy principal, HOD and three teachers were interviewed. In total, 25 participants took part in the study. In the interviews, six important questions were posed to the participants. Some participants acknowledged the positive contribution of ICTs in the classroom. However, negative contributions of ICTs were also raised which included access problems, connectivity problems, policy issues around use of cell phones by learners in schools and vandalism. The next chapter brings the study to a close by providing a summary of the work, conclusions and recommendations.

CHAPTER 6

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

The preceding chapter presented data, discussed and analysed the findings of the study. The chapter presented the analysis of quantitative data from learners and teachers. It also presented qualitative data from the teachers' interviews. The first part of the chapter focused on the response rate of both learners and teachers. The chapter also pointed out the limitations that were experienced during the data collection process. This chapter provides a holistic overview of the whole study and its purpose to ascertain whether the research's main question which sought to explore how the GDE promoted effective use of ICTs or e-learning programmes to improve learner and teacher performance in public secondary schools of Soweto. The study focused on the needs and challenges of schools in improving learners and teachers' performance through effective use of ICTs. This chapter gives a summary and conclusions of the study and proposes recommendations based on research findings. It also presents a model that can be used to improve the integration and use of ICT in schools to enhance teacher efficiency and learner performance and suggests areas for further research.

6.2 SUMMARY OF THE STUDY

The study has six chapters. Chapter 1 presented the introduction and background, the statement of the problem and the significance of the study. It also presented the research problem, the research questions and objectives, and rationale for the study. The chapter also gave definitions of important terms, and an overview of the research methodology is also provided in the chapter.

Chapter 2 outlined the theoretical framework and ICT education in South Africa. It reviewed literature on the use of ICTs in education with a special focus on South Africa. The chapter discussed how the theoretical framework of this study was adopted based on the comparison of selected learning theories, namely constructivism, behaviourism and connectivism. This was with reference to ICT use.

In Chapter 3, the introduction of ICTs and their impact on teaching and learning was presented. The chapter reviewed literature on ICT use in schools for teaching and learning. It reviewed literature on the use of ICTs in South Africa, other African countries and Europe. It focused on the use of ICT and three different teaching modes: traditional teaching mode, blended teaching mode and the online teaching mode. The chapter sought to establish the differences and similarities in ICT integration and use in teaching and learning. It further explored the positive aspects of ICTs in different countries and how these can be adopted in the South African context.

In Chapter 4, the research methodology and design of the study was presented. The chapter discussed the research methodology and design that was employed to investigate how the ICTs can be used effectively to enhance teachers and learners' performance in Soweto secondary schools. It gives the rationale for the choice of a mixed methods approach and outlines the population and sample of the study. The chapter also described the data collection process and instruments used in the study, namely semi-structured interviews, questionnaires and recording instruments. It further explained the data analysis process, and the validity and trustworthiness of the study.

In Chapter 5, there was an outline of data analysis, presentation and discussions. This chapter discussed data analysis, presentation and discussion of findings derived from the interviews and questionnaires. The analysis looked at the recurring patterns or themes and organised them thematically. The chapter also discussed, analysed, presented and interpreted data guided by the main research question, sub-questions and objectives of the study.

6.3 SUMMARY OF LITERATURE

The literature for this study covered education policy changes in South Africa, the history of ICTs in South Africa, current ICT status, ICT policies, teachers' attitudes towards ICTs, infrastructure in schools, theories related to ICTs and the impact of ICTs on teaching and learning. Several theories were explored to augment literature including connectivism, which was used as a theoretical framework to anchor the study. Connectivism theory is a relevant learning theory as it accommodates different learning objectives and knowledge construction (Downs, 2020:58; Makaring, 2023:5). The theory is crucial for the integration of ICTs in education in South Africa. Some of the benefits of integration include sharing resources and learning environments which promote collaborative learning and a general move towards greater learner autonomy (Di Pietro et al., 2020:9).

Insights from the theoretical framework could shed light on how teachers could effectively integrate ICTs in the teaching and learning process. From the themes and categories that emerged from the data, it is evident that many South African public schools have not yet achieved full and effective integration of ICTs into teaching and learning. South African schools are faced with several challenges such as insufficient number of computers, a lack of application software for all subjects, a lack of funds and a shortage of skilled teachers. All these factors render ICT integration in South African schools difficult to achieve.

The literature review covered in Chapter 2 and Chapter 3 clarified the contextual nature of the research problem and highlighted why the use of ICT in schools is significant and should be given high priority in education. Literature review underlined the importance of having an ICT policy and effective planning. It indicated that there is a relationship between a lack of effective ICT policies and unsuccessful integration of ICTs in schools. ICT education enhances the standard and quality of teaching and learning and teachers' instructional competences. Furthermore, ICT creates learner-centred pedagogy that allows learners to be fully involved in the learning activities and affords them an opportunity to plan and take charge of their own learning at their own pace (Hennessy et al., 2010:49; Mwalongo, 2011:45; Nyathi, 2022:59, UNESCO, 2012:6). The literature study also revealed that it is important for teachers in the twenty-first century to take up new teaching strategies or roles in order to teach effectively using ICTs (Mihaescu & Andron, 2019:10).

The literature study also highlighted the key role that principals can play in ICT implementation in schools. As institutional managers and instructional leaders, principals are responsible for ICT infrastructure and resources, ICT development of teaching staff and ensuring that ICTs are used effectively in teaching and learning (Hasin & Nasir, 2021:59).

6.4 SUMMARY OF QUANTITATIVE FINDINGS

This section provides a summary of the quantitative findings for both learners and teachers in attempting to answer the main research question below.

How best can the DBE promote effective utilisation of ICTs or e-learning programmes to improve the performance of learners and teachers in Soweto public secondary schools?

To address the main research questions comprehensively, the following subsidiary questions are posed:

a) How effective is the use of ICTs in improving learner and teacher performance in public secondary schools of Soweto?

b) How can the Gauteng Department of Education promote effective utilisation of ICTs to improve the performance of learners and teachers in public secondary schools of Soweto?

c) What can Soweto secondary schools do to promote effective utilisation of ICTs to improve learner and teacher performance?

d) How do learners and teachers in Soweto secondary schools overcome the challenges involved in the implementation of e-learning?

e) What role do teachers in Soweto secondary schools play in promoting effective utilisation of ICTs to improve learner and teacher performance?

6.4.1 Quantitative Findings – Learners

6.4.1.1 ICT laboratory/centre

As shown in Table 5.4 in Section 5.5, out of 85 learners from five schools, 90.6% (n=77) said their schools had computer laboratories/centres, while 9.4% (N=8)5 said they did not.

6.4.1.2 Number of computers at schools

Most teachers were not sure of the number of computers in their schools' computer laboratories/centres. They gave conflicting numbers as indicated in Table 5.4 in Section 5.5, which suggests that they did not know the actual numbers possibly because most of them had no access to these rooms apaart from the CAT teachers.

6.4.2.3 Used computers in the last six months

The findings tabulated in Table 5.5 indicated that participants were not sure of the exact numbers of computers; hence, they gave contradicting numbers. The only consistent response was from 39 (45.9%) learners who said there were 30 computers at their respective schools while other responses show that learners were just making guesses.

6.4.1.3 Use of computers in the past six months by learners

The findings from the data collected in Table 5.6 revealed that 58.8% (n=50) learners out of (n= 85) who responded had used computers for doing homework in the last six months. This was very encouraging since more than 50% of the learners answered 'Yes'. It is an indication that schools are moving in the right direction in encouraging learners to use computers for schoolwork-related matters. The data also revealed that 83.5% (n=71) learners out of the 85 learners who responded to the question agreed that they had used computers for learning in the last six months. Again, this is very positive and shows that secondary schools in Soweto are making big strides in the use of ICTs in the teaching and learning process. What is not known at this stage, however, is whether the use of computers in these schools is effective and if it is improving learner performance. The data further indicated that 69.4% (n=59) learners said they had used computers for research purpose in the last six months. This result is also a positive one because a number of learners indicated the use of computers in education-related matters. Nevertheless, we still need to establish whether all these positives lead to better learner performance in these schools.

6.4.1.4 The use of selected software applications by teachers

The findings from data collected and tabulated in Table 5.7 indicated that 91.8% (n=78) of learners said that their teachers used Microsoft Word for teaching and learning. Clearly, this was a positive outcome seeing that such many teachers were using Word for teaching and learning purposes. The number of learners who said that their teachers used PowerPoint for teaching and learning was 68.2% (n=58) out of 85 learners. This was another positive result since it showed that more than half of the teachers were using PowerPoint for teaching and learning purposes. About 49.4% (n=42) learners agreed that their teachers used Excel for teaching and learning processes. This is also encouraging because slightly above half of the teachers are using Excel for the teaching and learning purposes. From the 85 learners, about 44.7% (n=38) pointed out that their teachers used smart notebooks for teaching and learning purses. Although the number is slightly below half of the learners, it is still encouraging to note that many teachers in Soweto secondary schools are using smart notebooks. Lastly, 23.5% (n=20) of the 85 learners said that their teachers were using other things for teaching and learning purposes. It is, however, worrying because these teachers are not using the familiar ICTs that other teachers are using.

When it came to lesson preparation, 16.5% (n=14) of the 85 learners said that their teachers used Microsoft Word for lesson planning. This is very worrying because the number of teachers using Word for lesson preparation is very low. One cannot say therefore with certainty if it was an issue of availability of computers or a lack of Word skills on the part of the teachers. On teachers using PowerPoint, 18.8% (n=16) learners said their teachers were using PowerPoint for lesson preparation purposes. Again, this is worrying because the number is very low. When it comes to teachers using Excel for lesson preparation, 15.3% (n=13) learners pointed out their teachers used Excel for lesson preparation. This is also very low and not pleasing In addition, 11.8% (n=10) learners revealed that their teachers use smart notebooks for lesson preparation. This number is very low and not encouraging. About 9.4% (n=8) learners revealed that their teachers used other ICTs for lesson preparation. This is also worrying because they did not know with any certainty what these teachers were using. It is clear from the data that when it comes to lesson preparation not many teachers are using ICTs.

6.4.1.5 Learners confidence in using computers

Interestingly from the results that were collected and tabulated in Table 5.8, 14.1% (n=12) learners indicated that they were very confident when it came to the use of the computers; 48.3% (n=41) of the learners were confident in using a computer and other ICT instruments; 12.9% (n=11) indicated that they were fairly confident; and 24.7% (n=21) learners indicated that they were not confident at all. Overall, the data collected clearly established that 62.4% (n=53) learners were confident in using computers and other ICT instruments while about 15 learners were not confident. Therefore, it is encouraging to note that the number of learners who are not confident in using computers and other ICT instruments in the selected schools is very low. The high number of learners who indicated that they were confident in using ICTs may be attributed to the vigorous drive by GDE to introduce ICTs in their schools.

6.4.1.6 Learners skills in using computers

Collected data as indicated in Table 5.9 revealed that 88.2% (n=75) of the learners agreed that they had the necessary skills to use computers and other ICT instruments while 11.8% (n=10) said that they did not have the required skills. These statements are similar to the ones above when the learners were asked about their confidence levels in using computers. However, there was a slight increase of six learners who said they had the desired skills to operate computers compared to the number of learners who indicated that they were confident in using computers.

6.4.1.7 Reasons for not having computer skills

According to the data tabulated in Table 5.10, only 11.8% (N=10) learners indicated that they did not have the skills needed to operate a computer and other ICT instruments. They indicated that their lack of skills was attributed to the lack of training, no access to the internet and not having computers.

6.4.1.8 Devices mostly used by teachers

The data presented in Table 5.11 revealed that a total of 130 responses were recorded for all the questions asked on this question. Although there were 130 responses, we must take into cognisance that the responses for each section of the questions could have gone up to 85 responses per sector since we have a total of 85 participants. If all participants had all said yes to all the nine sectors of the question this would have taken the total responses to 765 in total. Therefore, the 30.1% (n=230) responses out of the possible responses of 765 in total is very low and is a cause for concern. Breaking it down further per sector, the data shows that 54.1% (n=46) of the learners acknowledged that their teachers use smart boards; 22.4% (n=190 acknowledged that their teachers used a data projector in the classroom; 45.9% (n=39) acknowledged that their teachers used overhead projectors; 61.2% (n=52) agreed that their teachers used whiteboards. Only 35.3% (n=30) endorsed that their teachers use interactive whiteboards. On the other hand, 36.5% (n=31) learners mentioned that their teachers used a chalkboard. From the total of 85 learners about 8.2% (n=7) pointed out that their teachers used a smart lab and 3.5% (n=3) acknowledged that their teachers used Smart Laboratories for teaching and learning. Lastly 3.5% (n=3) pointed out that their teachers did not use any of the listed devices for teaching and learning purposes in their classroom. Therefore, the data collected from the five schools clearly shows that many teachers in these schools are not using ICT and ICT-related instruments for teaching and learning in their schools.

6.4.1.9 Frequency in using selected ICT-related operations

The data presented in Table 5.12 indicates that the frequency of participants searching the internet varied. The participants who indicated that they never searched the internet was 43.5% (n=37); 9.4% (N=8) indicated they searched the internet several times a month; 16.5% (n=14) said they searched the internet at least once a month; and 30.6% (n=26) pointed out that they searched the internet every day or almost every day.

The frequency of participants' searches for learner resources used in the classroom also varied. Table 5.12 reveals that 29.4% (n=25) of the participants indicated that they never searched for learner resources; 25.9 (n=22)% said they searched for the resources several times, while 15.3% (n=13) indicated they did it at least once a month and 29.4% said they searched for learner resources on a daily basis. The participants' responses were also varied when they responded to how frequently they use applications like Microsoft Word, PowerPoint and Excel. Using. 4.7% (n=4) said never; 14.1% (n=12) said several times; 24.7% (n=21) indicated they did it at least once a month; and 56. 5% (n=48) said they did it every day or almost every day. The number of participants using these applications on daily basis is quite significant. This is very positive because many participants are embracing technology.

Many participants indicated that they did not use digital learning content and this is very worrisome. The table shows that 52.9% (n=45) never used it; 7.1% (n=6) used it once a month; 30.6% (n=26) at least once a month; and 9.4% (n=80) every day. The number of participants using digital learning was very low compared to the number of participants who did not use it at all. This could be attributed to a number of factors ranging from lack of ICT skills, lack of exposure to ICTs, connectivity issues and availability of ICT equipment.

Participants also gave varied responses on how frequently they used digital content. Table 5.12 indicates that 52.9% (n=45) of the participants indicated they never used digital content. Only 7.1% (n=6) conceded they used it several times a month, while 30.6% (n=26) and 9.4% (n=8) pointed out they used digital content on daily basis. Again, the statistics show that not many learners in the selected schools use digital content for their learning.

The responses to how frequently participants completed their exercises online were again different. 49.4% (n=45) of the participants said they never completed exercises online; a mere 11.8% (n=10) said they did it several times a month; 32.9% (n=28) pointed out that they did exercises at least once a month while 2.4% (n=2) said they completed the exercises every day. This is a cause of concern because not many participants were completing exercises online. This could be attributed to a number of issues like lack of ICT skills, lack of confidence in using ICTs, lack of training and lack of ICT equipment just mention a few.

Lastly 52.9% (n=45) participants said they never looked for professional development opportunities online; 11.8% (n=10) indicated they did it several times a month; 32.9% (n=28) did it at least once a month and only 2.4% (n=2) did it every day. Again, most participants are not using the online platform.

6.4.1.10 Awareness of ICT-related sites by learners

This question was answered by 85 learners who took part in the study from the selected schools. The statistics as communicated in Table 5.13 revealed that only 8.2% (n=7) participants were aware of Thuthong; 9.4% (n=8) learners were aware of Cyber classroom; 50.6% (n=43) participants were aware of E-books; 64.7% (n=68) participants knew about Siyavula; and only 7.1% (n=6) participants were not aware of all the listed items. According to the statistics collected not many learners were aware of the listed ICT instruments which is very worrisome. This is so because the listed ICT-related instruments are key to the improvement of teacher and learner performance which is the focus of the study. This means that the learners are already lagging behind when it comes to ICTs in their respective schools. Clearly, these learners fall behind when it comes to proficiency in the use of ICTs.

6.4.1.11 Being able to access subject content using ICTs

The data displayed in Table 5.14 revealed that a reasonable number of the participants – 84.7% (n=72) to be precise – knew how to access subject content using ICTs while 15.3% (n=13) did not know how to access subject content. Therefore, the number of learners who could access subject content using ICT was very high and quite pleasing. This was a very good sign and a boost for learners because they had an opportunity to improve their performance through adopting the use of ICTs for learning in their schools.

6.4.1.12 Reason for not being able to access subject content using ICTs

Table 5.15 in Chapter 5, Section 5.5 revealed that 7% (N=6) of the participants cited lack of ICT training as the reason why they could not access subject content using ICTs while 1.2% (n=1) said they had no access to a computer. However, 4.7% (n=4) blamed connectivity for their inability to access subject content using ICTs. Nevertheless, the number of participants who could access subject content using ICTs superseded those who could not, and this was very positive. It showed that participants were embracing technologies in their respective schools.

6.4.1.13 What computers should be used for

From all the data presented in Table 5.16, most learners were in agreement with computers being used for searching for learner sources, preparing lessons and presentations, creating own content, preparing learner exercises, assessment and providing learner feedback, and looking for online professional opportunities. In some instances, the learners even indicated that they strongly agreed. Only a small number of learners indicated that they did not agree.

6.4.1.14 Assistance needed for using certain listed ICT sites

This question was necessary to identify learners that still required assistance with certain ICT-related activities. Knowing the number of learners who are still struggling with certain ICT issues, stakeholders responsible for making sure that all learners in these schools are ICT competent would be in a better position to assist learners. Considering that 85 learners took part in the study, the data presented in Table 5.17 clearly showed that a few learners indicated that they needed help with using certain ICT tools. The only instances where the numbers were fairly high was on the use of smart boards, PowerPoint, Excel, multimedia downloading, ICT research and inserting videos.

6.4.2 Quantitative Findings – Teachers

6.4.2.1 Having ICT laboratories/centres

The data in Table 5.19 revealed that 67% (n=31) of the participants from the total of 46 who answered this question acknowledged that they had an ICT laboratory/centre. However, this was confusing because 22.6% (n=15) of the participants from the same schools pointed out that they did not have ICT laboratories/centres. It is difficult to deduce whether it was out of ignorance of the teachers or whether they did not know what an ICT laboratory/centre is.

6.4.2.2 Number of computers

From the statements gathered and tabulated, it is clear that most of the teachers were not really sure of the number of computers they had in their computer laboratories/centres. Teachers gave conflicting numbers and clearly it was a sign that they did not know the actual numbers. The reason could be the fact that apart from the CAT teachers, most teachers had no access to these rooms.

6.4.2.3 Use of selected software applications

The data in Table 5.21 depicted that most of the teachers used Word, PowerPoint and Smart Notebook for teaching and learning. Many teachers, however, according to the data collected, had not used Excel for teaching and learning. They also had not used Word, PowerPoint, Smart Notebook and Excel for lesson presentation perhaps because of a lack of skills in using such software. Therefore, teachers still need more training so that they can enhance their skills.

6.4.2.4 Confidence in using computer and other ICT instruments

The number of teachers who indicated that they were confident according to data depicted in Table 5.22, was 69.6% (n=32) while 15.2% (n=7) indicated they were not confident and another 15.2% were fairly confident. The number of participants who were confident was significantly high and pleasing. However, the expectation is that all teachers in schools should be confident when using ICTs. Therefore, some participants still need training when it comes to the use of computers and other ICT instruments.

6.4.2.5 Having necessary skills to use computers and ICT instruments

The data presented in Table 5.23 revealed that 82.6% (n=38) of the participants agreed that they had the required skills to use computers and other ICT instruments. However, this contradicts the number of participants who indicated that they were not confident as per Table 5.22. One could conclude that although teachers had the skills to operate computers and other ICT instruments, they did not have the confidence to use them in teaching possibly due to a lack of exposure.

6.4.2.6 Reason for not having necessary skills to use computers and ICT instruments

As data in Table 5.24 depicted, the number of teachers who said that they did not have skills were very few. However, most of these teachers need training on how to use computers and other ICT instruments for teaching.

6.4.2.7 Devices often used for teaching and learning

The data collected as depicted in Table 5.25 clearly showed that the most used device on the list was the whiteboard followed by the smart board and then the chalkboard. Other listed devices were not frequently used. It is at least encouraging that many teachers were using the smart boards which are very useful devices particularly in the digital age that we now find ourselves in. This is in support of the focus of this study which seeks to establish how teacher and learner performance can be improved through ICTs in Soweto secondary schools.

6.4.2.8 How frequent certain activities are done in class

According to data collected as indicated in Table 5.26, searching the internet for content taught in class is the most frequent activity, followed by searching for learners’ resources, searching for online professional development and then using digital content. The least used activities according to the data collected were using ICT to give feedback, completing learners’ exercises online and the use of PowerPoint. One can conclude that the less-used activities are a result of lack of teacher competence in those areas.

6.4.2.9 Awareness of selected sites

It is clear from the data in Table 5.27 (cf. 5) that many teachers were aware of E-books, Thutong, Siyavula and Cyber Classroom. However, four teachers did not know any of the listed and that leaves a lot to be desired.

6.4.2.10 Accessing subject content using ICTs

The statistics as shown in Table 5.28 revealed that 78.3%% (n=36) teachers agreed that they could access subject content using ICTs. This is very positive because in the twenty-first century, teachers are now expected to use ICTs for teaching and learning; hence there is considerable talk about the 4IR. The few who said they could not access subject content using ICTs attributed this to connectivity issues and lack of equipment like computers, software and the like.

6.4.2.11 Uses of computers and the internet

From the data displayed in Table 5.30, most teachers said the computers and the internet should be used for to prepare learners' exercises. It was also interesting to note that the responses from teachers for using computers and the internet to prepare lessons and presentations, creating their own content and for online professional development were all sitting at five responses respectively.

6.4.2.12 Assistance needed in using certain ICT applications

Table 5.31 revealed that 47.8% (n=22) participants needed help with creating interactive content on the smart board; 39.1% (n=18) participants indicated that they needed help with producing a spreadsheet using Excel; 30.4% (n=14) needed help with inserting a video or audio clip into a presentation. Another 30.4% (n=14) also needed help with multimedia downloading e.g., videos and audios. While 32.6% (n=15) needed help with interactive presentations using PowerPoint, and about 21.7% (n=10) teachers needed help with using ICTs for research purposes. This data clearly reveals that many participants were lacking critical ICT skills that are very important when teaching using ICTs

6.5 SUMMARY OF QUALITATIVE FINDINGS

This section provides a summary of the qualitative findings for teachers.

6.5.1 Participants' View on Whether ICTs Contribute Positively to the Teaching and Learning Process

The findings reflected that all respondents from the five schools agreed that the use of ICTs in their schools benefited them positively. They pointed out how ICTs made teaching and learning easier, especially the smart boards, which simplify teaching and save time because they could save all their notes on it and not need rewrite the notes each time. The participants also echoed that ICTs afforded them better and more effective ways of teaching especially through the use of videos, visuals and audio recordings just to mention a few. They explained that because of the use of ICTs, they were able to explain certain concepts and topics that would have been impossible to teach without these ICTs. Some even clarified that by using ICTs, they were able to show better shapes and drawings to learners since some teachers could not draw well. According to these teachers, ICTs also afforded them a better lesson planning and assessment platform. Simultaneously, ICTs remove boredom in the classroom, and is beneficial to visual learners. They also mentioned that with the use of ICTs, they were able to record their lessons, which saves time as indicated in their responses above.

6.5.2 Participants' Views on the Amount of Assistance Offered by the GDE in ICTs

All the participants from the five schools that took part in this study agreed that the GDE was trying hard to assist by making sure that teachers in school were trained on ICTs. The responses from all the participants from the five schools concurred that the GDE sent personnel to their schools to help with technical and software issues. In some schools, the person came once a week, while in other schools they went twice a week. The GDE also provided workshops for teachers on ICT. However, most of the participants echoed that the time slots for training were not convenient for most teachers due to other work-related commitments. They also explained that the time for training was insufficient and suggested that more time be allocated for training sessions.

6.5.3 Participants' Views on How Schools are Promoting Effective Use of ICTs to Improve Learner and Teacher Performance

In their responses, participants explained how they encouraged learners to use their smart phones in an attempt to promote the use of ICTs in their schools. Most participants mentioned that their schools had ICT committees responsible for running all ICT programmes. The ICT teams had coordinators that ran the committees. They commented on the sterling work that these ICT committees were doing. They also acknowledged the efforts that the SMTs put in place to support the use of ICTs and arranged training workshops for teachers at their respective schools.

6.5.4 Participants' Views on Challenges being Faced by Schools in the Usage of ICTs

Some participants pointed out that it was difficult for teachers to use ICTs in meetings because they did not have the necessary skills. In some schools, the issue of connectivity and access was a great concern for most teachers since not everyone had access to computers. In some schools, teachers said Wi-Fi only operated in certain areas of the school and was not accessible by all. Another challenge that the schools were facing according to teachers' responses was that teachers were not able to use smart boards and their features and were not confident to operate them in the classroom. It also emerged that some teachers took a long time to adapt to the use of ICTs. Regarding learners, the teachers said if not monitored properly in the classroom, learners accessed sites that were not educational, which wasted crucial learning time.

6.5.5 Participants' Views on How Schools Mitigated Challenges Associated With ICT Usage

Some teachers declared that nothing could be done to mitigate challenges related to ICT use, while others suggested strategies that could be employed. These included encouraging teachers to attend workshops on ICTs and improving connectivity at the school. Concerning internet security, they suggested that a frequent change of passwords could control the learners' regular use of the internet. One of the teachers' concerns was that learners use the internet to access some inappropriate sites that were not educational. Regarding support for teachers, some participants stated that schools could not employ full-time assistant staff due to financial constraints, which affected ICT support in schools. Accordingly, some participants suggested that schools employ full-time support person.

6.5.6 Participants' Views on What More Teachers Can Do to Promote Effective Use of ICTs in Schools

All participants agreed that teachers needed to be motivated to take the initiative in acquiring more knowledge and skills on the use of ICTs. In other words, teachers must take their self-development seriously. The participants also said now since the COVID-19 pandemic, teachers need to be more knowledgeable about ICTs than ever before. The fact that learners could not come to school did not mean that their education must stop. Instead, teachers needed to continue to teach them even when they were at home. Therefore, they should be more knowledgeable about the ICT platforms that they can use to continue teaching learners. The participants also mentioned that schools should liaise more with the donor community and sensitise communities to the importance of ICTs. This is vital since many children come from poor backgrounds and they cannot afford cell phones and data. When using ICTs, teachers should be innovative and creative to make sure that lessons are as lively as possible. They can do this by introducing videos and other visuals to the lessons to cater for all types of learners in the classroom. This is important because some learners are visual and understand concepts more when visuals are included in the lesson.

6.6 THE INTEGRATION OF QUANTITATIVE AND QUALITATIVE APPROACHES

The focus of this study was to explore how to improve learner and teacher performance through effective use of ICTs in Soweto secondary schools. To answer this question, both quantitative and qualitative approaches were used. The quantitative approach used descriptive statistics to analyse data drawn from learners and teachers from the five selected secondary schools in Soweto secondary schools. Quantitative data was collected through questionnaires, while qualitative data was generated through interviews with principals, deputy principals, HoDs and teachers. The two approaches were used simultaneously to allow the integration to occur during data collection, analysis and discussion of findings. These two approaches were integrated fully in Chapter 4 where both approaches were discussed and compared.

Quantitative data was analysed using descriptive statistics while qualitative data was analysed inductively from the themes that emerged from the interviews. Data from both interviews and questionnaires on ICT use in schools revealed six areas of focus. The categories are as follows:

a) Impact of ICTs.

b) Support from the Department of Education.

c) Promotion of ICT use in schools and security issues.

d) Challenges faced in the use of ICTs and mitigation measures.

e) Learners’ roles in ICT use and ICT policy issues.

f) Teachers and principals' roles in ICT use.

All six focus areas were addressed in detail in Chapter 5.

6.7 CONCLUSIONS

The research study provided an overview of the impact of ICTs on schools; the support that schools receive from the GDE; how ICTs are being promoted in schools; challenges being faced in schools with regard to ICT implementation and mitigation measures thereof; learners' roles in ICT use in schools and security issues; and teachers and principals' role in ICT use in schools. The conclusions on these findings are provided below.

6.7.1 The Impact of ICTs on Schools

The findings revealed that the implementation of ICTs in schools had both a positive and negative impact on the teaching and learning process. The research has established that the use of ICTs in the classroom has the potential to change and improve learner performance because technology can grab the learner's attention. Simultaneously, technology in education helps to motivate learners and provide them with a platform to engage and share their ideas with fellow learners. Despite the positive aspects that ICTs can bring to the classroom, the research also revealed that some schools are still experiencing challenges when it comes to ICT integration. These challenges range from lack of infrastructure, connectivity issues, ICT skilled teachers to the support to maintain the ICT equipment.

6.7.2 Support from the Gauteng Department of Education

The study also revealed that although schools receive support from the GDE in the form of support ICT personnel, most participants found this support inadequate and that more needed to be done. Most schools complained that they were not getting appropriate and adequate administrative and technical support from the GDE. This had negative implications for teaching and learning leading to their inability to deliver quality lessons to learners eventually leading to poor results.

6.7.3 ICT Skills

The findings of the study also revealed that although ICT use was promoted in schools, some teachers were still lagging behind in this regard. Some teachers felt that not enough ICT training was given. Teachers in some schools still felt that they need more training when it came to

ICTs. They believed they did not have adequate ICT skills to successfully present meaningful lessons to their learners. Teachers maintained that the GDE was not doing enough in this regard. Some teachers even went to the extent of empowering themselves when it comes to ICT skills.

6.7.4 ICT and Mitigation Measures

The data from the findings also revealed that there were actually more challenges than positives when it came to ICT use in the schools and that some schools had mitigation measures in place, but some still did not. Most schools reiterated the importance of monitoring sites that learners accessed. They did this by blocking some sites that were not educational. Schools also reiterated the importance of beefing up security when it came to ICT equipment since these became targets for thieves. Some schools mentioned that they had instituted ways of backing up information to avoid loss of information. When it came to ICT skills shortage, some schools had made it mandatory that teachers at their respective schools must attend all ICT training provided by both the school and the GDE. Most importantly, all schools mentioned the need improve connectivity so that learners benefited from the ICTs at the schools.

6.7.4 Learner Commitment

When it came to the learners' role in ICT use in schools, data revealed that learners played a pivotal role. For ICTs to be effective, learners should be interested, disciplined, cooperative and willing to learn new things. A lack of learner commitment adversely affects ICT use in schools.

6.7.5 Teachers' and Principals' Roles in the Use of ICTs

The study revealed the important role principals and teachers play in the use of ICTs in the schools. Principals play the pivotal role of leadership and managing the ICT implementation in schools. Simultaneously, teacher also play a very important role in the use of ICTs in schools. Without the teachers' full support and dedication to the cause, the whole teaching and learning process is greatly affected. Teachers play a pivotal role of making sure that ICTs are effectively being used in the classroom for the benefit of the learners. At the end of the day, the main aim is to make sure that the use of ICTs improves the performance of both learners and teachers in the classroom.

6.8 RECOMMENDATIONS

This study generated the following six focus areas:

i. Impact of ICTs

ii. Support from the Department of Education

iii. Promotion of ICT use in schools and security measures

iv. Challenges faced in the use of ICTs and mitigation measures

v. Learners' roles in ICT use and policy issues

vi. Teachers' and principals' roles in ICT use

In the six focus areas revealed by this study both positive and negative issues were raised. Therefore, in this section on recommendations, the focus is on suggesting and recommending what could be done in order to change all the negative issues to positives. These intervention measures will require the collaboration of all stakeholders so that the implementation of ICTs in Soweto secondary schools, Gauteng, can improve. I present the recommendations below.

6.8.1 Recommendations to the School

6.8.1.1 Impact of ICTs in schools and support from the GDE

It is difficult to study the impact of ICTs in schools because of the lack of evaluation especially in pilot phases of the study. It is possible however, to see certain trends like improved classroom-management practices, increased comfort with the use of ICTs as educational tools and increased motivation to participate in TPD programmes. For all this to be achievable, it is incumbent upon schools to make sure that teachers' approaches to classroom activities and student learning through the use of ICTs is changed.

Changing teachers' approaches to classroom activities is still a challenge in many schools in Soweto. It is therefore incumbent upon stakeholders in the implementation of ICTs in schools to make sure that they choose the TPD programme that suits each school context. The support that is given to schools in form of TPDs must move away from the idea of one-size-fits-all.

It is recommended that schools in Soweto should adopt a school-centred TPD approach. I recommend this approach because it focuses on longer-term change, usually via a "cascade" or “train-the-trainer” approach. Unlike standardised TPD which is typically a centralised approach, involving workshops, training sessions and in many cases the cascade model of scaled delivery, school-based TPD often takes place at the schools, resource centres or teacher training colleges. This model will afford the teachers an opportunity to work with local (“in house”) facilitators or master teachers. These help teachers to engage in a more gradual process of learning, and building mastery pedagogy, content and technology skills (World Bank, n.d.). The model will also be beneficial to teachers because it focuses on the specific, situational problems of the individual teacher and the particular school when it comes to the implementation of ICTs. Site-based TPD has many advantages because it tends to:

i. bring participants together to address local issues and needs over a period;

ii. encourage individual initiative and collaborative approaches to problems;

iii. allow more flexible, sustained and intensive TPD; and

iv. provide ongoing opportunities for professional learning among a single set of teachers.

On the contrary, school-based TPD can be time-consuming which can present challenges. Some of the challenges can be mitigated by making sure that locally based TPD providers that are skilled in facilitation, instruction, content, curriculum, assessment and technology are used. If used in Soweto schools, I believe that this model will result in success. Teachers will be working with concrete situations using concrete objects and not working abstractly. The problem when people work abstractly is that they can forget and the training received can go to waste. The school-based TPD advocates pragmatism (that is, fusing theory with practical). Therefore, with this approach, it is the responsibility of the principal, the school management team (SMT), the GDE and all stakeholders to make sure that everyting necessary is done to ensure that teachers at the school get the support they need when it comes to ICTs. The school must afford more teachers in the school the opportunity to become master teachers for the school-based TPD to ensure its success.

It is important that when TPD programmes are developed for ICT teacher training that the focus is on incorporating essential subject content knowledge from teacher’s particular disciplines. The first consideration therefore should be teachers’ pedagogical knowledge and technical abilities on using ICTs. Teachers must not only be content to use ICTs for administrative activities because there is more that they need to know when it comes to ICTs. Teachers need to also equip themselves with enhanced pedagogical skills as opposed to merely improving their computer skills. This is important because the integration of ICTs cannot be achieved in one short training programme. There is need for extensive and enduring training coupled with pedagogy. This supported by Bingimlas (2009); Mhlanga and Moloi (2020:9) and Nyathi (2022:79) when they echoed that the development of proper pedagogical knowledge and its appropriate application to ICT are more crucial than the technical ability to using the ICT. The findings from this research, however, revealed that most teachers in Soweto schools still do not have sufficient competency to incorporate ICT and pedagogy into their disciplines. Again, most of the teachers do not have a comprehensive knowledge of the vast range of ICT tools and resources for integrating ICTs effectively in the classroom.

6.8.1.2 Teachers and learners' roles, security and policy issues

Teachers and learners play a very pivotal role when it comes to security and ICT policy issues. It is the responsibility of the learners and teachers to make sure that all ICT instruments at the school are no vandalised. Educators have a role to ensure that learners understand the value and importance of all ICT instruments at the school. Teachers need to discourage learners from vandalising these instruments. Simultaneously teachers need to engage learners in the drawing up of ICT policies at the schools. This approach will help make learners feel that they are part of decision-making. Obviously, the added advantage is that learners tend to respect and follow policy that they feel they helped to put in place. In other words, they develop a sense of ownership and respect towards the policy.

6.8.2 Recommendations to the Gauteng Department of Education

6.8.2.1 Support

The GDE must acknowledge the fact that learning does not end with workshops. Teachers need continuous support, assistance and motivation so that they can implement the skills and concepts they have learned in the TPD. The GDE must also understand that schools cannot hope to provide such support on their own. Schools will need adequate resources, and school leaders who understand the goals and challenges associated with change. The support must not lack in any way, and it must be well-coordinated to avoid putting the whole investment in the TPD in jeopardy. This section proposes five key areas of focus for the GDE. These five critical areas include choosing of the correct TPD programme for Soweto schools, teacher incentives, supporting TPD in schools, infrastructural support for TPD and WEB resources.

6.8.2.2 Choosing the most appropriate TPD for Soweto secondary schools

It is pivotal to note that when dealing with schools in a resource-poor environment, their need for onsite support is high. Since most schools in Soweto are still not well-resourced like the former model C schools because of the educational imbalances that existed in the past I therefore recommend that TPD programmes for poor schools be adapted to meet the conditions in schools, focusing only on the types of activities teachers are able to successfully carry out. These Soweto schools must also be provided with ample resources for them to succeed. The available infrastructure does not actually need to be state-of-the-art but it must enable teachers to use prescribed TPD tools and resources effectively. However, despite all these suggestions, the TPD for these Soweto secondary schools may still encounter challenges. Incorporating ICTs would go a long way to addressing many challenges but will also give rise to new challenges.

6.8.2.3 Teacher incentives

The data collected in this study showed that some teachers in Soweto schools are not keen to embrace the use of ICTs. I recommend therefore that the GDE takes cognisance of the fact that to change their practices, teachers they need support, motivation and incentives. Both intrinsic and extrinsic incentives should be considered in designing TPD programmes for Soweto secondary schools. Increased performance is one of the effective intrinsic incentives. For example, teachers will adopt an innovation when they see that it will add value, is easy to use and when they are given enough time and the support they need for their teaching purposes in the classroom.

However, self-motivation without any rewards for experimentation and innovation is very hard to sustain. Teachers, like students, also need extrinsic incentives and motivation to carry out their duties and improve their teaching. Most importantly if any project incorporates both intrinsic and extrinsic incentives, this will help teachers find satisfaction in learning while reaping tangible rewards for a job well done. The following extrinsic motivators can go a long way in encouraging teacher participation in TPD programmes organised by the GDE:

a) Stipends for TPD;

b) Accreditation or certification;

c) Access to new or additional educational resources;

d) Promotion or Job retention linked to TPD attendance, ICT use or innovative practices;;

e) Micro-credit support for purchases of computers;

f) Advancement through stages of additional TPD;

g) Compulsory participation in TPD; and

h) Rewards and recognition by school leadership, parents' groups and community leaders.

6.8.2.4 Supporting TPD in schools

Whenever TPD programmes are given to teachers, it is important to ensure that teachers implement the innovations learned through the TPD. These innovations can be either active learning or using spreadsheets to record grades. The types of support the teachers can be given range from follow-up support, administrative support, technical support and collaborative support. It is important to recognise that if any of this support is lacking, the entire investment on TPD will be in jeopardy. The four key support area will be discussed below.

i. Follow-up support: For any TPD, human support is pivotal. It is important that teachers are afforded access to a follow-up person, coach or mentor. It is also critical that these support persons are enthusiastic about improving education, are willing to invest in the success of individual teachers and the TPD programmes, and are experts in instruction, curriculum, assessment and classroom management. It is also essential that the education system should appoint capable mentors or coaches. If mentors and coaches are lacking, efforts should be made to identify potential sources of such personnel. It is, therefore, the responsibility of the GDE to make sure that follow-up support is given to all Soweto secondary schools.

ii. Support from leadership: Although teachers need access to external follow-up persons, it is the responsibility of the GDE to encourage school leadership to fully support their teachers. The school leadership can provide support by setting expectations for teachers, establishing a culture and climate that encourages and rewards change and experimentation, providing the time and resources for teachers to practise what they have learned in TPD programmes and demonstrating effective leadership to help everyone in the school embrace change.

iii. Support from the community: The GDE has a duty to make sure that communities rally behind schools in Soweto when it comes to ICTs. When community are actively behind the schools, teachers will feel better about themselves and their work and treat students better when they feel that they are valued by the community. The GDE in collaboration with the schools in Soweto can achieve communities' involvement by:

a) initiating outreach activities, such as visits to the computer lab;

b) establishing a computer-lab steering communities that include community members, parents, teachers and students;

c) offering computer training or internet use to community members;

d) presenting TPD and ICT project information to parents' groups; and

e) helping to establish alumni organisations that will help support educational programmes like ICT-related TPDs.

iv. Technical support: It is common knowledge that computers break down. Therefore, schools need someone to fix these computers and if the technical support is hours away then these computers cannot be used and will eventually be abandoned. This will result in a waste of investment when it comes to TPD and ICTs. Therefore, the GDE should make it a point that whenever they come up with TPD programmes, adequate funds are available to sustain the programme. The GDE needs to provide all schools in Soweto with permanent school-based technical support personnel, contracting existing private sector technical support providers, seeking better tariffs when it comes to internet connectivity, and identifying ICT projects or NGOs that can partner with the GDE in supporting schools with technical support.

v. Collaborative support: To help teachers overcome barriers they may encounter in schools, programmes should include structures that allow for collaboration among teachers. The collaboration will afford teachers the opportunity to constantly share their challenges and other issues with other teachers. Teachers will improve their own performance as well as that of their colleagues, develop confidence, become more self-motivated and be able to rely more on each other. Obviously, when teachers work together in communities, they will experience collaboration, inquiry and independent learning. With the experiences gained, they can then use them to improve teaching and learning in the classroom.

6.8.2.5 Infrastructural support for TPD

When dealing with ICTs, infrastructural support is pivotal. Infrastructural support for TPD includes items such as classroom space and electrical power, and the educational infrastructure of knowledge resources and curricula assessment. Some of the critical support items include the following:

a) physical infrastructure which includes tables, desks, writing materials, classroom space, computer facilities which electrical outlets and burglar bars;

b) technical infrastructure which includes electrical power, internet connectivity, radios, batteries, computer hardware and software;

c) manuals, guidelines and teaching aids which include print-based guides to hardware and infrastructural materials;

d) educational infrastructure which includes modification to curricula, educational standards, and teachers' guides and student assessment needed to support TPD.

6.9 THE PROPOSED MODEL

For teachers to improve their effectiveness in using ICTs in the teaching and learning process, I propose a five-phase model that can be used in Soweto secondary schools. This model is based on the TPCK framework illustrated in Figure 6.1.

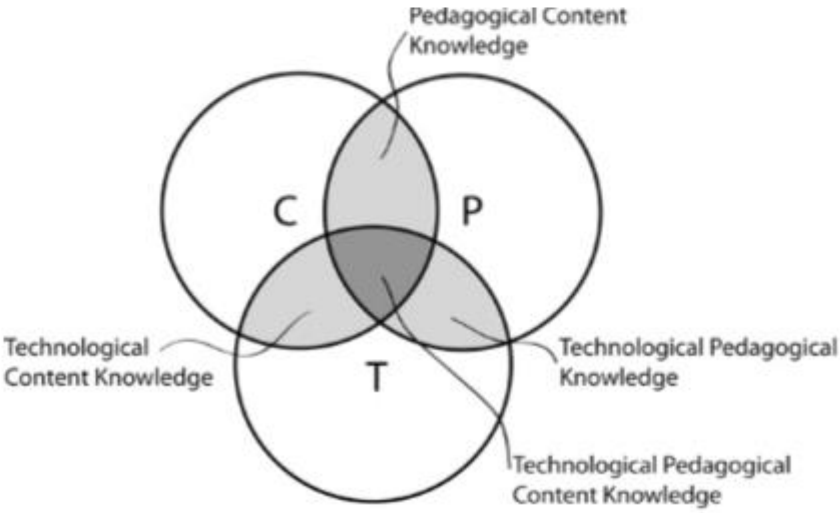

Figure 6.1: TPCK framework

Source: (Koehler & Mishra, 2005)

The theoretical model emphasises that teachers first need to have technological content knowledge before pedagogical content knowledge. This implies that the first thing teachers need to do is to have a comprehensive knowledge of the ICTs before they can use them for teaching and learning purposes. When teachers have mastered the technological content, they also need to master the pedagogical knowledge where they actually have to master the art of teaching and all the theories associated with teaching. After having mastered the two, then teachers need to master the technological pedagogy knowledge. The technological pedagogical knowledge (TPK) is the art of using ICTs for teaching and learning purposes. Then lastly teachers need to master TPCK which is all the content relating to the use of ICTs for teaching and learning processes. In fact, the TPCK becomes the new way of teaching which incorporates the TCK, the PCK and the TPK (Koehler & Mishra, 2009).

The researcher assumes that effective use of ICTs in the teaching and learning in secondary schools in Soweto can only be achieved if the TPCK is applied in five phases as shown in the model above. The model was adapted from the Bangladesh Training model which had only three phases that were relevant in carrying out effective TPD in line with the TPCK. However, the researcher felt that the Bangladesh model was lacking certain critical levels. Two more critical phases have been added in the model below that is proposed for Soweto secondary schools.

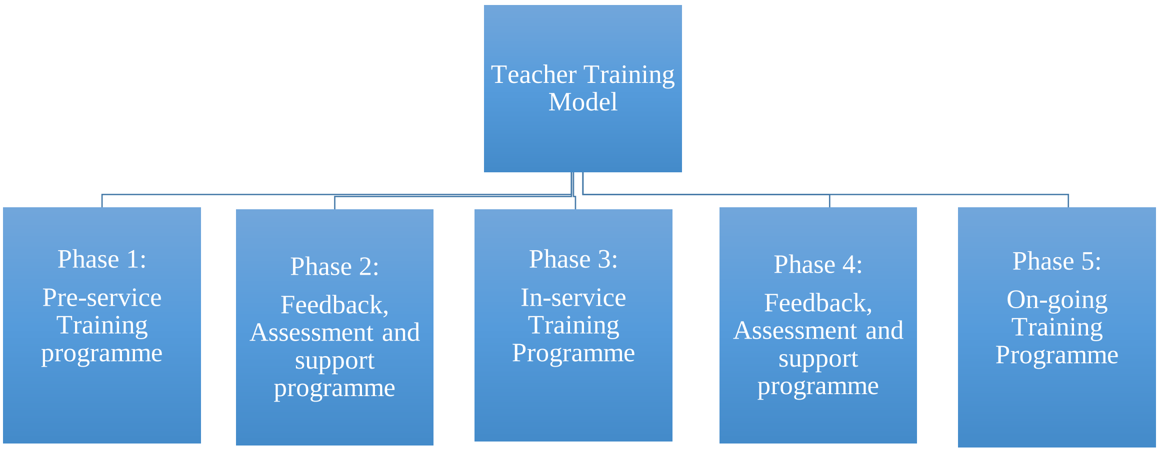

Figure 6.2: Proposed five-phase training model for Soweto schools in line with the TPCK model

Source: adapted from Khan (2014)

Phase 1 (Pre-service training programme): This first phase focuses on training all the students who aspire to become teachers in the future. It is assumed that all these aspiring teachers do not have any prior teaching experience, do not know how to use ICTs effectively in the teaching and learning process and do not have adequate content knowledge. With that in mind, these aspiring teachers need to first undergo pre-service training according to the model provided above. This will help boost their skills in using ICTs for teaching and learning. Not only will they gain ICT skills for teaching and learning but the will also gain skills on how to use these ICTs for administrative purposes.

Phase 2 (Feedback, assessment and support programme): This phase is a very important phase considering the fact that the aspiring teachers that were trained in Phase 1 did not have any prior knowledge of teaching or of using ICTs in the teaching and learning process. Getting feedback on the whole training process becomes critical in this phase to ascertain the level of teachers' competence after the pre-service training. Assessments are also used to assess if the teachers have acquired the desired skills for them to use in the classroom. Obviously if the teachers are facing challenges, support will be given so that they can be confident in their teaching using ICTs in the classroom.

Phase 3 (In-service training programme): In this stage, experienced teachers who are currently working as teachers in Soweto schools are used to train other teachers. The trainers should consider a few significant aspects such as the characteristics of the trainees, competence of trainees and how they will train these trainees. Interestingly the trainees at this stage usually portray similar characteristics. For example, they do not have previous teaching experience even though they might have the content and pedagogical knowledge. Therefore, they could all be struggling with integrating pedagogy and content. The ideal about this in-service training programme is that it is a planned, face-to-face type of training which provides flexibility and is organised according to the trainee's previous pre-service training.

Phase 4 (Feedback, assessment and support): This phase is critical in the sense that, when any training programme is conducted, it is important to evaluate whether the programme was successful or not. This can only be achieved by getting feedback from the trainees, assessing them and giving them support where they might be struggling. This key to the success of the programme. In Phase 4, trainees need to give feedback on their training and mention challenges they are facing and simultaneously be given the necessary support by the trainers.

Phase 5 (Ongoing training programme): This phase emphasises the importance of ongoing training of teachers according to their specific needs and requirements. This phase takes into consideration all the challenges the trainee encountered from the pre-service training programme through to the in-service training programme. The phase also takes into account the fact that technology is changing rapidly, and teachers need to continuously update their teaching skills (Ramavath, 2020). For teachers to keep abreast of these changes, they need to keep updating their teaching skills through continuous ongoing professional development programmes; hence, the importance of this last phase. Schools must understand that when it comes to ICT training programmes of teachers, it must not be a once-off event but an ongoing programme.

6.10 LIMITATIONS OF THE RESEARCH STUDY

The biggest challenge and criticism of using the qualitative research approach is that it depends on the researcher's evaluation which can be subject to research bias (Noble & Smith, 2015:1). This study used a mixed method approach which included qualitative research; hence, there are bound to be limitations. When using the qualitative approach in research, the researcher's views and perspectives will end up being the deciding factor in the research findings. For this reason, qualitative research has limitations. This study revealed some limitations which will be discussed below.

6.10.1 Sample Size

The sample for this study comprised of 15 teachers, five HoDs and five principals/deputy principals from five secondary schools in Soweto secondary schools. This sample was relatively small when it comes to ascertaining how the use of ICTs can improve learner and teacher performance in Soweto secondary schools. Perhaps a larger sample could have given a better view of how the effective use of ICTs can contribute to learner and teacher performance.

6.10.2 Researcher Objectivity

The mere fact that the selection of participants and schools to take part in this study was subject to the discretion of the researcher is a limitation. The researcher was the one who was responsible for selecting the schools and participants which could also have been subject to researcher bias. Another question that could be asked is that of fairness in the selection of the schools and participants to make sure that there was no bias.

6.10.3 Insecurity Issues

Something that came up when the study was being carried out is that some participants had feelings of insecurity, which was a limitation. One could assume that since the participants were feeling insecure, their responses may not have been totally honest since they feared speaking out for fear of victimisation. This was the case even though the researcher had given his assurance that their responses would be kept confidential. Therefore, when participants refused to answer certain questions, the researcher had no choice but to go on to the next question.

6.10.4 Data Collection Times

Data collection is an integral part of any study; hence, it should be done properly. For this study the researcher spent over four months collecting the data. Four months might sound like a long time but for this study it was too short. The time that was suitable for data collection for this study in my view should have been at least six months. The data that needed to be collected was voluminous and the fact that the researcher was using a mixed method approach meant that more time was needed. Another issue that affected data collection was that, at the time when the researcher wanted to collect data, the country went on lockdown because of the COVID-19 pandemic. The pandemic caused schools to close for a long time and made it very difficult to collect data. When schools were finally opened the authorities had put many restrictions in place to avoid the spread of the virus. Not all learners and teachers were coming to school, and this had a negative impact on data collection. The researcher had to make do with the participants that were available on a particular day and needed make additional arrangements for collecting data when other participants were available. Therefore, the collection of data under the conditions that were there during the pandemic proved problematic for the researcher and may have affected the quality of data collected.

6.10 SUGGESTIONS FOR FURTHER RESEARCH

- The focus of this study was exclusively on whether the use of ICTs improved learner and teacher performance in Soweto secondary schools. However, there is need for an in-depth study on looking at challenges schools face when it comes to the actual use of ICTs in schools in the South African context.

- There is need for further exploration on ICT uses and challenges faced in Gauteng schools using larger samples from as many schools as possible. This could point to strategies for effective use of ICTs in Gauteng schools for the improvement of performance for both learners and teachers.

- It is recommended that further studies be carried out on which TPDs models are appropriate and effective for Soweto secondary schools when it comes to ICT use.

6.11 CONCLUSION

The twenty-first century demands that all teachers must use ICTs in the teaching and learning process regardless of their geographical location, age and socioeconomic background. This is vital because without the integration of ICTs into pedagogic activities, preparation for the twenty-first citizenry and workforce will not be a reality. As discussed in Chapter 3, the connectivity, behaviourist and constructivist theories provide the platform for embedding ICTs in teaching and learning. Studies that were done on the three paradigms revealed that no theory is better than the others when it comes to the inclusion of ICTs for teaching and learning process. Literature also revealed that the use of ICTs in education by various nations of the world is essential in the twenty-first century. Effective and creative implementation of the use of ICTs could create opportunities for more effective teaching. However, besides the positives of ICT integration in teaching and learning, literature argued that there are conditions that hinder the full use of these ICTs by the teachers.

According to literature, the conditions that hinder the effective integration of ICTs in the teaching and learning process in South African schools are the disconnect between ICTs policies and practice in schools. It was revealed that many schools do not have ICT policies in place. Recommendations were made from the findings of the study that school principals in their role as ICT leaders and teachers as pedagogic practitioners should make sure that the use of ICTs is taken seriously in their respective schools. It was also recommended that intensive training to promote teachers' ICT skills be accelerated. Training of teachers was emphasised because ineffective use of ICTs by teachers in schools was caused by the lack of training. For that reason, this study advocated for teacher training programmes with specific needs that will develop pedagogical and technological knowledge to enable them to integrate ICTs in their teaching and learning process in their respective schools. Obviously, the training would consist of a combination of the TPACK model and the TPD training model that was proposed in Chapter 6.

The study also revealed that it is very important that whenever TPD programmes are given to teachers, it is important to ensure that teachers implement the innovations learned through the TPD. These innovations can be either active learning or using spreadsheets to record grades. The types of support the teachers can be given range from follow-up support, administrative support, technical support and collaborative support. It is important to recognise that if any of this support is lacking, the entire investment in TPD will be in jeopardy. There is need to ensure that teachers are empowered to teach as is expected in the twenty-first century.

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APPENDICES

APPENDIX A: UNISA ETHICS APPROVAL CERTIFICATE

UNISA COLLEGE OF EDUCATION ETHICS REVIEW COMMITTEE

Date: 2019/09/11

Dear Mr Kumbula

Decision: Ethics Approval from 2019/09/11 to 2024/09/11

Ref: **2019/09/11/61925349/26/MC**
Name: Mr J Kumbula
Student No.: 61925349

Researcher(s): Name: Mr J Kumbula
E-mail address: joshkumbula@gmail.com
Telephone: +27 79 265 3411

Supervisor(s): Name: Prof M Lekhetho
E-mail address: Lekhem@unisa.ac.za
Telephone: +27 12 429 3781

Title of research:
Improving learner and teacher performance through effective use of ICTs in Soweto Secondary Schools, Gauteng Province.

Qualification: D. Ed in Education Management

Thank you for the application for research ethics clearance by the UNISA College of Education Ethics Review Committee for the above mentioned research. Ethics approval is granted for the period 2019/09/11 to 2024/09/11.

*The **medium risk** application was reviewed by the Ethics Review Committee on 2019/09/11 in compliance with the UNISA Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.*

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the UNISA College of Education Ethics Review Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance.
7. No field work activities may continue after the expiry date **2024/09/11**. Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

The reference number **2019/09/11/61925349/26/MC** *should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*

Kind regards,

Prof AT Motlhabane
CHAIRPERSON: CEDU RERC
motlhat@unisa.ac.za

Prof PM Sebate
ACTING EXECUTIVE DEAN
Sebatpm@unisa.ac.za

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

APPENDIX B: GDE RESEARCH REQUEST APPLICATION FORM

GAUTENG PROVINCE
Department: Education
REPUBLIC OF SOUTH AFRICA

For admin. use
Ref. no.:

GDE RESEARCH REQUEST FORM

REQUEST TO CONDUCT RESEARCH IN INSTITUTIONS AND/OR OFFICES OF THE GAUTENG DEPARTMENT OF EDUCATION

PARTICULARS OF THE RESEARCHER

1.1	**Details of the Researcher**
Surname and Initials:	Kumbula. J.
First Name/s:	Joshua
Title (Prof / Dr / Mr / Mrs / Ms):	Mr.
Student Number (if relevant):	61925349
ID Number:	7201275946181

1.2	Private Contact Details
Home Address	Postal Address (if different)
34 Langeberg Avenue	P.O. Box 88188
Bosmont	Newclare
Johannesburg	

Postal Code: 2093	Postal Code: 2112
Tel: 011 474 2055 Ext 117	
Cell: 079 265 3411	
Fax:086 724 6091	
E-mail: joshkumbula@gmail.com	

PURPOSE & DETAILS OF THE PROPOSED RESEARCH

2.1	Purpose of the Research (Place cross where appropriate)
Undergraduate Study – Self	
Postgraduate Study – Self	X
Private Company/Agency – Commissioned by Provincial Government or Department	
Private Research by Independent Researcher	
Non-Governmental Organisation	
National Department of Education	
Commissions and Committees	
Independent Research Agencies	
Statutory Research Agencies	
Higher Education Institutions	

2.2	Full Title of Thesis / Dissertation / Research Project
Improving Learner and Teacher performance through effective use of ICTs in Soweto secondary schools, Gauteng Province.	

2.3	**Value of the Research to Education (Attach Research Proposal)**
Will attach Research Proposal	

2.4	**Proposed date of completion of study / project and submission of research findings to GDE**
Completion date:	2020-12-30
Submission to GDE date:	2021

2.5	**Student and Postgraduate Enrolment Particulars (if applicable)**
Name of institution where enrolled:	University of South Africa (UNISA)
Degree / Qualification:	D.Ed.
Faculty and Discipline / Area of Study:	Education Leadership and Management
Name of Supervisor / Promoter:	Prof. M. Lekhetho

2.6	**Employer (where applicable)**
Name of Organisation:	St Barnabas College

Position in Organisation:	Educator
Head of Organisation:	Heather R. Carolus
Street Address:	34 Langeberg Avenue Bosmont
	Johannesburg
Postal Code:	2093
Telephone Number (Code + Ext):	011 474 2055
Fax Number:	011 474 2249
E-mail:	carolush@stbarnabas.co.za

2.7	**PERSAL Number (where applicable)**

2	3	1	2	0	6	1	4

PROPOSED RESEARCH METHOD/S

(Please indicate by placing a cross in the appropriate block whether the following modes would be adopted)

Questionnaire/s (If Yes, supply copies of each to be used)

YES	X	**NO**	

Interview/s (If Yes, provide copies of each schedule)

YES	x	**NO**	

Use of official documents

YES		**NO**	x
If Yes, please specify the document/s:			

Workshop/s / Group Discussions (If Yes, Supply details)

YES		**NO**	X

Standardised Tests (e.g., Psychometric Tests)

YES		**NO**	X
If Yes, please specify the test/s to be used and provide a copy/ies			

INSTITUTIONS TO BE INVOLVED IN THE RESEARCH

Type of Institutions (Please indicate by placing a cross alongside all types of institutions to be researched)

INSTITUTIONS	Mark with X here
Primary Schools	
Secondary Schools	X
ABET Centres	
ECD Sites	
LSEN Schools	
Further Education & Training Institutions	
Other	

Number of institution/s involved in the study (Kindly place a sum and the total in the spaces provided)

Type of Institution	Total
Primary Schools	
Secondary Schools	5
ABET Centres	
ECD Sites	
LSEN Schools	
Further Education & Training Institutions	
Other	

GRAND TOTAL	5

Name/s of institutions to be researched (Please complete on a separate sheet if space is found to be insufficient)

Name/s of Institution/s
Emadwaleni Secondary School
Forte Secondary School
Kelokitso Comprehensive School
PJ Simelane Secondary School
Matseliso Secondary School

District/s where the study is to be conducted. ***(Please indicate by placing a cross alongside the relevant district/s)***

District	
Ekhuruleni North	
Ekhuruleni South	
Gauteng East	
Gauteng North	
Gauteng West	
Johannesburg Central	
Johannesburg East	
Johannesburg North	

Johannesburg South	
Johannesburg West	X
Sedibeng East	
Sedibeng West	
Tshwane North	
Tshwane South	
Tshwane West	

If Head Office/s (Please indicate Directorate/s)
N/A

Number of learners to be involved per school (Please indicate the number by gender)

Grade	***1***		***2***		***3***		***4***		***5***		***6***	
Gender	**B**	**G**	**B**	**G**	**B**	**G**	**B**	**G**	**B**	**G**	**B**	**G**
Number												
Grade	***7***		***8***		***9***		***10***		***11***		***12***	
Gender	**B**	**G**	**B**	**G**	**B**	**G**	**B**	**G**	**B**	**G**	**B**	**G**
Number									**10**	**10**		

Number of educators/officials involved in the study (Please indicate the number in the relevant column)

Type of staff	***Educators***	***HoDs***	***Deputy Principals***	***Principal***	***Lecturers***	***Office Based Officials***
Number	**65**	**5**		**5**	**N/A**	**N/A**

Are the participants to be involved in groups or individually?

Participation	
Groups	
Individually	x

Average period of time each participant will be involved in the test or other research activities (Please indicate time in minutes)

Participant/s	Activity	Time
Educators/HoDs/ Principals	Interviews	20-30 minutes
Educators/HoDs/ Principals	Questionnaires	10-20 minutes
Learners	Questionnaires	10-20 minutes

Time of day that you propose to conduct your research

Before school hours	**During Break**	**After School Hours**
	X	

School term/s during which the research would be undertaken

First Term	**Second Term**	**Third Term**
X		

CONDITIONS FOR CONDUCTING RESEARCH IN GDE

Permission may be granted to proceed with the above study subject to the conditions listed below being met and may be withdrawn should any of these conditions be flouted:

The District/Head Office Senior Manager/s concerned must be presented with a copy of this letter that would indicate that the said researcher/s has/have been granted permission from the Gauteng Department of Education to conduct the research study.

The District/Head Office Senior Manager/s must be approached separately & in writing, for permission to involve District/Head Office Officials in the project. A copy of this letter must be forwarded to the school principal and the chairperson of the SGB that would indicate that the researcher/s have been granted permission from the Gauteng Department of Education to conduct the research study.

A letter / document that outline the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs and District/Head Office Senior Managers of the schools and districts/offices concerned, respectively.

The researcher will make every effort obtain the goodwill and cooperation of all the GDE officials, principals & chairpersons of the SGBs, teachers and learners involved. Persons who offer their cooperation will not receive additional remuneration from the Department while those that opt not to participate will not be penalised in any way.

Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal (if at a school) and/or Director (if at a district/head office) must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage.

Research may only commence from the second week of February and must be concluded before the beginning of the last quarter of the academic year. If incomplete, an amended Research Approval letter may be requested to conduct research in the following year.

Items 6 and 7 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education. It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.

The researcher is responsible for supplying and utilising their own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.

The names of the GDE officials, schools, principals, parents, teachers and learners that participate in the study may not appear in the research report without the written consent of each of these individuals and/or organisations. On completion of the study the researcher must supply the Director: Knowledge Management & Research with one Hard Cover bound and an electronic copy of the research.

The researcher may be expected to provide short presentations on the purpose, findings and recommendations of their research to both GDE officials and the schools concerned. Should the researcher have been involved with research at a school and/or a district/head office level, the Director concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.

DECLARATION BY THE RESEARCHER	
I declare that all statements made by myself in this application are true and accurate.	
I accept the conditions associated with the granting of approval to conduct research and undertake to abide by them.	
Signature:	
Date:	**12/09/2019**

NB. If a group of Students / Researchers will be conducting the same research in the same / different GDE Institutions, Annexure A (attached) must be completed and signed by each researcher.

This form (and all other relevant documentation where available) may be completed and forwarded electronically to Diane.Buntting@gauteng.gov.za The last two pages of this document must however have the original signatures of both the researcher and their supervisor or promoter. (For Group Research Annexure A, must also have original signatures.) These pages may be faxed to (086 594 1781) or hand delivered (in a sealed envelope) to Diane Buntting, Room 509, 111 Commissioner Street, Johannesburg. All enquiries pertaining to the status of research requests can be directed to Diane Buntting on tel. no. 011 843 6503.

ADDITIONAL INFORMATION FOR GROUP RESEARCH

This information must be completed by **every** researcher/student who will be visiting GDE Institutions for research purposes.

By signing this declaration, the researcher / student accepts the conditions associated with the granting of approval to conduct research in GDE Institutions and undertakes to abide by them.

Supervisor/ Promoter / Lecturer's Surname and Name

DECLARATION BY RESEARCHERS / STUDENTS

Surname & Initials	**Tel**	**Cell**	**E-mail address**	**Signature**

APPENDIX C: REQUEST FOR PERMISSION FROM GDE TO CONDUCT RESEARCH IN SCHOOLS

The District Manager

Johannesburg West District

101 Northern Parkway

Johannesburg West

Orrmonde -2091

Dear Sir/Madam

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN SCHOOLS

My name is Joshua Kumbula. I am a student at the University of South Africa in the College of Education under the supervision of Professor M. Lekhetho. The research I wish to conduct for my PhD studies is titled: **Improving learner and teacher performance through effective use of ICTs in Soweto secondary schools, Gauteng province.** The purpose of this study is to determine how teacher and learner performance can be improved through effective use of ICTs in Soweto secondary schools.

I am hereby seeking your consent to visit secondary school teachers, principals and learners in Soweto (Johannesburg West) in your district to conduct interviews and handing out questionnaires regarding effective ICT use in teaching and learning with the aim of improving teacher and learner performance.

The participants' identity will be anonymous and whatever will be said during the interview will be kept strictly confidential. Participation of the participants will be voluntary and they may withdraw from participating without any consequence. The interviews will take between 20 and 40 minutes respectively. There will not be any compensation for participating in the study.

The report of the findings of the study will be communicated to all the participants and I can be contacted at joshkumbula@gmail.com or 0792653411. Your consideration to my request will be greatly appreciated.

Thank you

Yours Sincerely

Joshua Kumbula

UNISA college of education

APPENDIX D: GDE RESEARCH APPROVAL LETTER

GAUTENG PROVINCE
Department: Education
REPUBLIC OF SOUTH AFRICA

8/4/4/1/2

GDE RESEARCH APPROVAL LETTER

Date:	26 September 2019
Validity of Research Approval:	04 February 2020 – 30 September 2020 2019/283
Name of Researcher:	Kumbula J
Address of Researcher:	34 Langeberg Avenue
	Bosmont
	Johannesburg, 2093
Telephone Number:	011 474 2055/ 079 265 3411
Email address:	joshkumbula@gmail.com
Research Topic:	Improving Learner and Teacher performance through effective use of ICTs in Soweto Secondary schools, Gauteng Province.
Type of qualification	D Ed
Number and type of schools:	Five Secondary Schools
District/s/HO	Johannesburg West

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

26/09/2019

The following conditions apply to GDE research. The researcher may proceed with the above study subject to the conditions listed below being met. Approval may be withdrawn should any of the conditions listed below be flouted:

1

Making education a societal priority

Office of the Director: Education Research and Knowledge Management
7th Floor, 17 Simmonds Street, Johannesburg, 2001
Tel: (011) 355 0488
Email: Faith.Tshabalala@gauteng.gov.za
Website: www.education.gpg.gov.za

1. Letter that would indicate that the said researcher/s has/have been granted permission from the Gauteng Department of Education to conduct the research study.
2. The District/Head Office Senior Manager/s must be approached separately, and in writing, for permission to involve District/Head Office Officials in the project.
3. A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB) that would indicate that the researcher/s have been granted permission from the Gauteng Department of Education to conduct the research study.
4. A letter / document that outline the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs and District/Head Office Senior Managers of the schools and districts/offices concerned, respectively.
5. The Researcher will make every effort obtain the goodwill and co-operation of all the GDE officials, principals, and chairpersons of the SGBs, teachers and learners involved. Persons who offer their co-operation will not receive additional remuneration from the Department while those that opt not to participate will not be penalised in any way.
6. Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal (if at a school) and/or Director (if at a district/head office) must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage.
7. Research may only commence from the second week of February and must be concluded before the beginning of the last quarter of the academic year. If incomplete, an amended Research Approval letter may be requested to conduct research in the following year.
8. Items 6 and 7 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education.
9. It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.
10. The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.
11. The names of the GDE officials, schools, principals, parents, teachers and learners that participate in the study may not appear in the research report without the written consent of each of these individuals and/or organisations.
12. On completion of the study the researcher/s must supply the Director: Knowledge Management & Research with one Hard Cover bound and an electronic copy of the research.
13. The researcher may be expected to provide short presentations on the purpose, findings and recommendations of his/her research to both GDE officials and the schools concerned.
14. Should the researcher have been involved with research at a school and/or a district/head office level, the Director concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.

Kind regards

Mrs Faith Tshabalala
Acting Director: Education Research and Knowledge Management

DATE: 26/09/2019

Making education a societal priority

Office of the Director: Education Research and Knowledge Management
7th Floor, 17 Simmonds Street, Johannesburg, 2001
Tel: (011) 355 0488
Email: Faith.Tshabalala@gauteng.gov.za
Website: www.education.gpg.gov.za

APPENDIX E: REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN SCHOOLS

The Principal

Emadwaleni Secondary school

10898 Armitage Street

Orlando West

Johannesburg west

1852

Dear Sir/Madam

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN SCHOOLS

My name is Joshua Kumbula. I am a registered PhD student at the University of South Africa in the College of Education under the supervision of Professor M. Lekhetho. I wish to conduct a study at your school titled: **Improving learner and teacher performance through effective use of ICTs in Soweto secondary schools, Gauteng province.** The purpose of this study is to determine how learners and teachers' performance can be improved through the effective use of ICTs in Soweto secondary Schools, Gauteng Province.

I am writing to request permission to interview principals, teachers and Heads of Department (HoDs). I would also request to hand out questionnaires to 10 teachers and 20 learners. The interviews will be conducted after school hours and each interview will take between 20 to 40 minutes respectively. I will also audio record participants during the interview sessions. The information obtained will be kept strictly confidential. It is my presumption that the findings of this study will make a credible contribution in how learners and teachers can effectively use ICTs effectively to improve their performance for better academic results at the school.

For further information about the study, you are free to contact me at joshkumbula@gmail.com or 0792653411.

Thank you

Yours sincerely

Joshua Kumbula

APPENDIX F: LETTER OF PRINCIPALS' CONSENT

Dear Participant

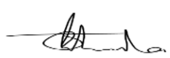
My name is Joshua Kumbula. I am a PhD student at the University of South Africa in the College of Education under the supervision of Professor M. Lekhetho. You are invited to participate in a research study titled: **Improving learner and teacher performance through effective use of ICTs in Soweto secondary schools, Gauteng province.** The purpose of the study is to determine how learner and teacher performance can be improved through effective use of ICTs in Soweto secondary schools in Gauteng province.

I am writing to request your permission to interview the principal and the teachers who use ICTs in their teaching. The interviews will be conducted after school hours and each interview will take between 20 to 40 minutes.

Participants will be asked to answer a few interview questions regarding the topic of the study. Teachers and learners will also be asked to complete a short questionnaire regarding the study in question. I hope that this study can elicit the reasons and obstacles that prevent teachers from effectively using ICTs to improve their performance with regard to delivery of lessons in the classroom and make recommendations that can be adopted for effective use of ICTs in schools. There are no identified risks from participants in this study. The interviews will involve audio recordings with the researcher. Neither names nor any other identifying information will be associated with the audios recording or transcripts. The participants' identities will be anonymous and what will be said during the interview will be kept strictly confidentially. Your participation is voluntary and you may withdraw from participating without any consequence. There will be no compensation for participating in this study.

The report of the findings of this research study will be communicated to all the participants and I can be contacted at joshkumbula@gmail.com or 0792653411. Thank you for your consideration. I am looking forward your participation in this research. Your signature on the reply slip indicates that you have read the above information, are an adult and agree to participate in the study of how learners and teachers' performance can be improved through effective use of ICTs in Soweto schools in Gauteng province.

Yours Sincerely



Joshua Kumbula

APPENDIX G: LETTER OF CONSENT BY TEACHERS

Dear Participant

My name is Joshua Kumbula. I am a PhD student at the University of South Africa in the College of education under the supervision of Professor M. Lekhetho. You are invited to participate in a research study titled: **Improving learner and teacher performance through effective use of ICTs in Soweto secondary schools, Gauteng province.** The purpose of the study is to determine how learner and teacher performance can be improved through effective use of ICTs in Soweto secondary schools in Gauteng province.

You will be asked to answer a few interview questions regarding the topic of the study. You can also be asked to complete a short questionnaire regarding the study in question. I hope that this study can elicit the reasons and obstacles that prevent teachers from effectively using ICTs to improve their performance with regard to delivery of lessons in the classroom and make recommendations that can be adopted for effective use of ICTs in schools. There are no identified risks from participants in this study. The interviews will involve audio recordings with the researcher. Neither your name nor any other identifying information will be associated with the audio recording or transcript. The participant's identity will be anonymous and what will be said during the interview will be kept strictly confidentially. Your participation is voluntary and you may withdraw from participating without any consequence. The interview will take between 20 t0 40 minutes of your time to complete. There will be no compensation for participating in this study.

The report of the findings of this research study will be communicated to all the participants and I can be contacted at joshkumbula@gmail.com or 0792653411. Thank you for your consideration. I am looking forward your participation in this research. Your signature on the reply slip indicates that you have read the above information, are an adult and agree to participate in the study of how learners and teachers' performance can be improved through effective use of ICTs in Soweto schools in Gauteng province.

Yours Sincerely

Joshua Kumbula

APPENDIX H: REPLY SLIP

Improving learner and teacher performance through effective use of ICTs in Soweto secondary schools, Gauteng Province

Complete this reply slip and return it by fax on 086 724 6091

OR

E-mail to me at joshkumbula@gmail.com

OR

Telephone at 079 265 3411

RESEARCH REPLY SLIP

I am willing to be interviewed

Yes No

☐ ☐

I am interested in being interviewed, but I would like to discuss the research for some clarifications before engaging in the project. Yes No

☐ ☐

My Name is ____

Telephone ____

Address ____

If I do not hear from you, I will assume that you are not interested in the study.

Your cooperation will be greatly appreciated.

APPENDIX I: LETTER OF CONSENT FOR LEARNERS

Dear Participant

My name is Joshua Kumbula. I am a PhD student at the University of South Africa in the College of education under the supervision of Professor M. Lekhetho. Your principal has given me permission to do this study at your school. I would like to invite you to be a very special part of my research study titled: **Improving learner and teacher performance through effective use of ICTs in Soweto secondary schools, Gauteng province.** The purpose of the study is to determine how learner and teacher performance can be improved through effective use of ICTs in Soweto secondary schools.

You will be asked to fill in questionnaires regarding the topic of the study. I hope that this study can elicit the reasons and obstacles that prevent teachers from effectively using ICTs to improve their performance with regard to delivery of lessons in the classroom and make recommendations that can be adopted for effective use of ICTs in schools. There are no identified risks from participants in this study. Neither your name nor any other identifying information will be associated with the information on the questionnaire and will be kept strictly confidential. Your participation is voluntary and you may withdraw from participating without any consequence. The questionnaire will be easy to complete and will take a few minutes of your time to complete. There will be no compensation for participating in this study.

The report of the findings of this research study will be communicated to all the participants and I can be contacted at joshkumbula@gmail.com or 0792653411. Thank you for your consideration. I am looking forward your participation in this research.Your signature on the reply slip indicates that you have read the above information, are an adult and agree to participate in the study of how learners and teachers' performance can be improved through effective use of ICTs in Soweto schools.

Do not sign the written assent form if you have any questions. Ask your questions first and ensure that someone answers those questions.

WRITTEN ASSENT

I have read this letter which asks me to be part of a study at my school. I have understood the information about the study and I know what I will be asked to do. I am willing to be in the study.

______________________________ ___________________________

Learners' name (print) Learners' signature: Date:

___________________________ ___________________________

Witness's name (print) Witness's signature Date:

____

Parent/guardian's name (print) Parent/guardian's signature Date:

______________________________ ____________________________

Researcher's name (print) Researcher's signature Date:

APPENDIX J: SAMPLE – COVER LETTER FOR RESEARCH QUESTIONNAIRE

Dear respondent

My name is Joshua Kumbula. I am a PhD student at the University of South Africa in the College of Education under the supervision of Professor M. Lekhetho. This questionnaire forms part of my doctoral research titled: **Improving learner and teacher performance through effective use of ICTs in Soweto secondary schools, Gauteng province**. You have been selected by randomly selected using a Multi-stage technique either from all Grade 11 lists learners or list of staff at the school. Hence, I invite you to take part in this survey. The aim of the study is to investigate how to improve learner and teacher performance through effective use of ICTs in Soweto secondary schools. You are kindly requested to complete this survey questionnaire, comprising 12 questions honestly and frankly as possible and according to your personal views and experience. No foreseeable risks are associated with the completion of the questionnaire which is for research purposes only. The questionnaire will take approximately 15 minutes to 20 minutes to complete.

You are not required to indicate your name or organisation and your anonymity will be ensured; however, indication of your age, gender, occupation position etcetera will contribute to a more comprehensive analysis. All information obtained from this will be used for research purposes only and will remain confidential. Your participation in this survey is voluntary and you have the right to omit any questions if so desired, or to withdraw from answering this survey without penalty at any stage. After the completion of the study, an electronic summery of the findings of this study research will be made available to you on request. Permission to undertake this survey has been granted by the University of South Africa and the Ethics committee of the college of Education, UNISA. If you have any research related enquiries, they can be addressed directly to me or my supervisor. My contact details are: 079 265 3411 emails joshkumbula@gmail.com and my supervisor can be reached at 012 429 3781 Department of Leadership and Management, College of Education, UNISA, e-mail: lekhem@unisa.ac.za

By completing the questionnaire, you imply that you have agreed to participate in this research. Please return the completed questionnaire to me before the end of October, 2022.

Thank you

Yours Sincerely

Joshua Kumbula

APPENDIX K: QUESTIONS TO GUIDE THE INTERVIEWS

1. Do you think the use of ICTs in your school is contributing positively to the teaching and learning process?
2. What assistance are you getting from the Gauteng Department of Education as a school on how to effectively use ICTs in the teaching and learning process?
3. How do you as a school promote effective use of ICTs in order to improve learner and teacher performance?
4. What challenges do you have as a school in using ICTs for the teaching and learning process?
5. How do you mitigate or manage these challenges as a school?
6. What more can teachers at your school do to make sure that ICTs are effectively used in the teaching and learning process in order to improve learner and teacher performance?

APPENDIX L: QUESTIONNAIRE TO GUIDE TEACHERS

Biographical Information

Gender: Male ☐ Female ☐

Name of the school:

Qualifications:

Teaching experience: ……………………… Years

Which subject(s) do you teach?

Which grade(s) are you currently are you currently teaching?

1. Do you have an ICT laboratory/centre?

Yes ☐ No☐

If yes, how many computers are available in the ICT laboratory/centre?

2. Have you used computers for the following in the last 6 months?

	Yes	No	Not used it in the last 6 months
Lesson Preparation	☐	☐	☐
Teaching In class	☐	☐	☐
School	☐	☐	☐

Management and Administration related Tasks (e.g planning, timetabling, mark sheets Budgeting etc.)

3. Which of the following software applications do you use to do the following?

	Teaching and learning	Lesson preparation	Do not use it
Word	☐	☐	☐
PowerPoint	☐	☐	☐

Excel	☐	☐	☐
Smart Notebook	☐	☐	☐
Other	☐	☐	☐

4. How confident are you in using a computer and other ICT instruments?

Explain:………………………………………………………………………………………

5. Do you feel you have the necessary skills to use computers and other ICT instruments?

☐ Yes ☐ No

6. If your answer is no to the above question, please give reasons.

…………………………………………………………………………………………………

7. Identify the devices you most often use for teaching and learning.

☐ Smart board

☐ Data Projector

☐ Overhead Projector

☐ Whiteboard

☐ Interactive whiteboard (Not smart board)

☐ Chalkboard

☐ None of the above

☐ Videos

☐ Smart lab

☐ Other

8. How frequently do you do the following activities with your class?

	Never	**Several times a month**	**At least once A week**	**Every day or almost every day**
Search the internet for content in lesson preparation				
Search for learner resources to be used in class e.g. Worksheets, past exam papers				
Use application word. Powerpoint, excel) to present lessons				
Create your own digital learning content e.g. Online quizzes				
Prepare learner exercises				
use ict to provide feedback and assess learners				
look for online professional development opportunities				

9. Are you aware of the following sites?

Thutong ☐

Cyber classroom ☐

E-books ☐

Siyavula ☐

None of the above ☐

10. Are you able to access subject content using ICT?

☐ Yes ☐ No

If your answer is NO to the question above, please provide a reason.

……………………………………………………………………………………………………

11. Computers and the internet should be used for:

	Strongly disagree	**Disagree**	**Agree**	**Strongly Agree**
Searching for learner resources				
Prepare lessons and presentations				
Creating your own content				
Prepare learner exercises				
Assessing and providing learners with feedback				
Look for online professional development opportunities				

12. Do you need assistance for the following?

☐ Produce a document using Word

☐ Produce a presentation using PowerPoint

☐ Produce a spread sheet using Excel

☐ Create interactive content on smart board

☐ Use emails to communicate with others

☐ Using ICT in teaching and learning

☐ Multimedia (downloading a video, audio equipment etc.)

☐ Inserting a video or audio clip into a presentation

☐ Sharing a video file

☐ Use social media for communication e.g., face book, twitter, skype, blogs etc.

☐ Other

Specify if other:

APPENDIX M: QUESTIONNAIRE TO GUIDE LEARNERS

Biographical Information

Gender: Male ☐ Female ☐

Name of the school:

Which subjects do you do?

What grade are you currently are in?

1. Do you have an ICT laboratory/centre

Yes ☐ No☐

If yes, how many computers are available in the ICT laboratory/centre?

2. Have you used computers for the following in the last 6 months?

	Yes	No	Not used it in the last 6 months
Doing home work			
Learning in class			
Doing research			

3. Which of the following software applications does your teacher use to do the following?

	Teaching and learning	Lesson preparation	Do not use it
Word			
PowerPoint			
Excel			

4. How confident are you in using a computer and other ICT instruments?

Explain:……………………………………………………………………………………………

5. Do you feel you have the necessary skills to use computers and other ICT instruments?

☐ Yes ☐ No

6. If your answer is no to the above question, please give reasons.

7. Identify the devices your teacher most often uses for teaching and learning at your school.

☐ Smart board

☐ Data Projector

☐ Overhead Projector

☐ Whiteboard

☐ Interactive Whiteboard (Not smart board)

☐ Chalkboard

☐ None of the above

☐ Videos

☐ Smart lab

☐ Other

8. How frequent do you do the following activities with your class?

	Never	**Several times**	**At least once a**	**month**	**At least once a week**	**Every day or almost every day**
Search the internet for content taught in class						
Search for content, resources used in class e.g. Worksheets, past exam papers						
Use applications (e.g. Word. Powerpoint, Excel)						
Used digital learning content e.g. Online quizzes						
Completed learner exercises online						
Look for online professional development opportunities						

9. Are you aware of the following sites?

Thutong ☐

Cyber classroom ☐

E-books ☐

Siyavula ☐

None of the above ☐

10. Are you able to access subject content using ICT?

☐ Yes ☐ No

If your answer is NO to the question above, please provide a reason.

11. Computers and the internet should be used for:

	Strongly disagree	**Disagree**	**Agree**	**Strongly Agree**
Searching for learner resources				
Prepare lessons and presentations				
Creating your own content				
Prepare learner exercises				
Assessing and providing learners with feedback				
Look for online professional development opportunities				

12. Do you need assistance for the following?

☐ Produce a document using Word

☐ Produce a presentation using PowerPoint

☐ Produce a spread sheet using Excel

☐ Create interactive content on smart board

☐ Use emails to communicate with others

☐ Using ICT for research purposes

☐ Multimedia (downloading a video, audio equipment etc.)

☐ Inserting a video or audio clip into a presentation

☐ Sharing a video file

☐ Use social media for communication e.g., face book, twitter, skype, blogs etc.

☐ Other

Specify if it’s other:

………………………………………………………………………………………………………

APPENDIX N: DECLARATION BY SUPERVISOR / PROMOTER / LECTURER

DECLARATION BY SUPERVISOR / PROMOTER / LECTURER	
I declare that: (Name of Researcher) Joshua Kumbula	
is enrolled at the institution / <u>employed by the organisation to which the undersigned is attached.</u>	
The questionnaires / structured interviews / tests meet the criteria of: *Educational Accountability* *Proper Research Design* *Sensitivity towards Participants* *Correct Content and Terminology* *Acceptable Grammar* *Absence of Non-essential / Superfluous items*	
Surname:	
First Name/s:	
Institution / Organisation:	
Faculty / Department (where relevant):	
Telephone:	
Fax:	
E-mail:	
Signature:	
Date:	

APPENDIX O: TURNITIN REPORT

IMPROVING LEARNER AND TEACHER PERFORMANCE THROUGH EFFECTIVE USE OF ICTs IN SOWETO SECONDARY SCHOOLS, GAUTENG PROVINCE

ORIGINALITY REPORT

22%	18%	8%	10%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	uir.unisa.ac.za Internet Source	5%
2	Submitted to University of South Africa Student Paper	3%
3	hdl.handle.net Internet Source	2%
4	pt.scribd.com Internet Source	1%
5	Submitted to Tshwane University of Technology Student Paper	1%
6	pdfs.semanticscholar.org Internet Source	1%
7	www.researchgate.net Internet Source	1%
8	Mlunghisi D. Mathevula, Dominique E. Uwizeyimana. "The Challenges Facing the	1%

APPENDIX P: EDITORIAL DECLARATION

Blue Diamonds Professional Editing Services (Pty) Ltd

Polishing **your** brilliance

Email: jacquibaumgardt@gmail.com

Website: www.jaybe9.wixsite.com/bluediamondsediting

30 August 2023

Declaration of editing

Improving learner and Teacher performance through the effective use of ICTs in Soweto secondary schools, Gauteng Province

by

Joshua Kumbula

I declare that I have edited and proofread this thesis. My involvement was restricted to language usage and spelling, completeness and consistency and referencing style. I did no structural re-writing of the content.

I am qualified to have done such editing, being in possession of a Bachelor's degree with a major in English, having taught English to matriculation, and having a Certificate in Copy Editing from the University of Cape Town. I have edited more than 500 Masters and Doctoral theses, as well as articles, books and reports.

As the copy editor, I am not responsible for detecting, or removing, passages in the document that closely resemble other texts and could thus be viewed as plagiarism. I am not accountable for any changes made to this document by the author or any other party subsequent to the date of this declaration.

Sincerely,

JBaumgardt

Dr J Baumgardt
UNISA: D. Ed. Education Management
University of Cape Town: Certificate in Copy Editing
University of Cape Town: Certificate in Corporate Coaching

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+44 789 514 6059
jacquibaumgardt@gmail.com
https://jaybe9.wixsite.com/bluediamondsediting

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