Transforming Education through the implementation of ICT pedagogical integration: A case of ICT and Non- ICT schools in South Africa

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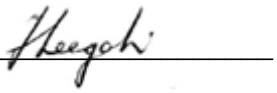
Declaration

I, Tarishma Seegobin, hereby declare that this thesis titled “Transforming Education through the implementation of ICT pedagogical integration: A case of ICT and Non- ICT schools in South Africa” is my own original work. It has not been submitted for any other degree or diploma in any university or other tertiary institution except as duly declared within the text. To the best of my knowledge and belief, this thesis contains no material previously published or written by another person except where due reference is made in the text and the bibliography.



Signature

2024-07-18

Date

Dedication

I dedicate this thesis to my father, Mr. Ramesar Ramouthar, whose unwavering belief in me has served as a constant source of motivation and inspiration throughout my academic journey. I particularly admire his work ethic, resilience, intellectual curiosity, perseverance, and his unwavering belief that he can achieve anything he sets his mind to. His dedication to hard work and lifelong learning instilled in me the values that made this achievement possible.

This work is also dedicated to my sons, Nihal, and Ayush Seegobin. Nihal, with your reserved nature, I recognize the strong determination and intellectual strength that allows you to be motivated and work quietly to achieve your goals. Ayush, with your artistic and creative mind, coupled with your ability to connect with everyone, you possess a social charm that wins hearts. May this dissertation serve as a testament to the power of perseverance. Remember, "the sky is not the limit." I encourage you both to embrace lifelong learning, pursue your dreams with relentless determination, embrace all opportunities offered and understand that dedication and hard work are the cornerstones of success.

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Abstract

This study investigates the complexities of integrating Information and Communication Technologies (ICTs) into educational practices within Johannesburg, Gauteng province, South Africa. Despite national aspirations outlined in the ICT in Education policy, the White Paper on e-Education (2004), there are challenges that hinder the effective integration of ICTs in classrooms. This results in the exacerbation of the digital divide due to the uneven policy implementation across schools.

This qualitative research aims to identify essential components and principles for successful ICT integration in diverse educational settings. It is a case study that sought to understand the socially constructed nature of ICT integration within specific school contexts to understand how the implementation of ICT pedagogical integration unfolds in South African schools. It is thus guided by Collis and van der Wende's model (2002). Four purposefully selected public primary schools, encompassing both those with adequate ICTs (provided by government) and those with inadequate resources (basic ICTs procured by the schools) participated in this study. The schools are situated in both township and suburban areas. Semi-structured interviews were conducted with 16 participants (four from each school), including principals and educators teaching across all phases, viz Foundation, Intermediate and Senior.

The findings reveal several critical factors influencing ICT integration. Policy ambiguity emerges as a major obstacle. Inadequate awareness and inconsistent interpretations of the policy seem to hinder implementation efforts. Furthermore, educator preparedness is compromised by insufficient ICT knowledge, skills, and training, limiting their ability to effectively integrate technology into their teaching practices. Resource paucity, encompassing infrastructure limitations, inadequate technical support, and financial constraints, further impede ICT adoption Leadership style significantly influences the level of ICT integration within an organization. Younger leaders often demonstrate a greater willingness to adopt and implement ICT compared to their more experienced counterparts. Finally, the absence of robust monitoring and evaluation mechanisms undermines sustained support for ICT initiatives.

To address these challenges and unlock ICT's potential for educational transformation, the study recommends a multifaceted approach . Revisions to policies for clarity and consistency are crucial. Strategic resource allocation, targeted at professional development programs, enhanced communication channels, and fostering leadership support are essential. Stakeholder collaboration is vital to ensure a holistic approach. Furthermore, the study proposes the development of a versatile

ICT framework (RISE) specifically tailored to the South African context, aiming to foster inclusive learning environments and bridge the digital divide within educational institutions.

Keywords: ICT, pedagogy, integration, implementation, inequity, challenges, strategy, digital-divide

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Chapter One: Study Background and Overview

1.1 Introduction

The use of Information and Communication Technology (ICT) in teaching and learning has become universal across the world, and that has left the South African education system with no option but to embrace this technological paradigm by designing policies that can provide guidelines for education institutions. The South African ICT policy in Education, the White Paper on e-Education (DoE, 2004) was designed with the intention to complement the national curriculum statement, the Curriculum Assessment Policy Statement (CAPS) to ensure that learners are exposed to modern technologies and thus prepare them to contribute to the emerging information society. Spearheaded by the Department of Education (DoE), the 2004 White Paper on e-Education, the only ICT policy in education to date, marked a pivotal moment in the nation's effort to revolutionize education through the transformative power of ICTs. Recognizing ICTs as a potent catalyst for educational advancement, the White Paper outlined a comprehensive roadmap, encompassing a set of ambitious goals and strategic initiatives to harness ICTs for the betterment of South Africa's education landscape.

At the heart of the White Paper lay the unwavering commitment to enhancing the quality of education for all learners, bridging the gaps in accessibility, aligning education with the demands of the economy, and streamlining the overall efficiency and effectiveness of the education system. To achieve these overarching objectives, the White Paper meticulously crafted a multi-faceted strategy, encompassing a series of concrete actions. Firstly, the White Paper prioritized expanding the availability and utilization of ICTs within schools, ensuring that these transformative tools were readily accessible to educators and learners alike. Simultaneously, the White Paper advocated for the development and deployment of ICT-based teaching and learning resources, providing educators with a rich arsenal of digital tools to enhance their pedagogies and engage learners in dynamic learning experiences. Recognizing the crucial role of educators in effectively integrating ICTs into the classroom, the White Paper underscored the importance of comprehensive educator training. Through dedicated programs and workshops, educators were equipped with the necessary skills and knowledge to confidently navigate the digital landscape and seamlessly incorporate ICTs into their teaching practices. To establish a robust foundation for ICT-enabled education, the White Paper envisioned the development of a national ICT infrastructure specifically tailored to the needs of the education sector. This infrastructure would ensure seamless connectivity across schools, enabling the unfettered flow of digital resources and fostering a collaborative learning environment.

Furthermore, the White Paper extended its reach beyond the traditional confines of the school system, advocating for the integration of ICTs into adult education and lifelong learning initiatives. By empowering adults with digital literacy and skills, the White Paper sought to promote continuous learning and personal development, fostering a society equipped to embrace the ever-evolving demands of the digital age. (Naicker, 2023; DoE, 2004). The South African ICT White Paper on e-Education served as a beacon of hope and a catalyst for change, heralding a new era of ICT-driven educational transformation (Naicker, 2023). Its far-reaching vision and strategic roadmap have undeniably left an indelible mark on South Africa's educational landscape, paving the way for a future where ICTs empower educators, engage learners, and propel the nation towards a brighter, more technologically empowered future. Consequently, many schools have been equipped with ICTs. However, there are discrepancies in the implementation of ICT pedagogical integration in the classroom (Mlambo et al., 2020). The South African ICT White Paper on e-Education, while ambitious in its vision, faced several discrepancies that ultimately hindered its successful implementation (Chomunorwa, Mashonganyika & Marevesa, 2023; Tshimanika, Chigona, & Sadeck, 2022). One of the primary challenges was the lack of a clear and comprehensive plan for resource allocation (DoE, 2004). The White Paper outlined grand goals but failed to provide a detailed roadmap for securing the necessary funding, infrastructure, and human resources to bring these aspirations to life (Tshimanika et al., 2022; Chisango et al., 2020). This resulted in a fragmented approach to implementation, with initiatives scattered across various departments and agencies, lacking the coordination and cohesion required for a cohesive and impactful rollout (Tshimanika et al., 2022).

Furthermore, the White Paper's emphasis on top-down implementation strategies overlooked the importance of contextualizing ICT integration to the specific needs and realities of diverse schools and communities (DoE, 2004). Without considering the varying levels of ICT readiness, infrastructure access, and educator expertise across the country, the White Paper's blanket approach failed to address the unique challenges faced by different regions and educational settings within South Africa (Chomunorwa et al., 2023; Tshimanika et al., 2022). This resulted in a sense of disconnection and disengagement among stakeholders, who felt that the White Paper's solutions were not tailored to their specific contexts (Tshimanika et al., 2022). Additionally, the White Paper's implementation timeline proved to be overly ambitious, setting unrealistic expectations for the pace of change (DoE, 2004). The rapid transformation envisioned by the White Paper underestimated the complexities of integrating ICTs into a complex and often resistant education system (Tshimanika et al., 2022). This led to frustration and disillusionment among stakeholders, who witnessed the gap between the White Paper's bold promises and the slow pace of implementation on the ground (Tshimanika et al., 2022). Despite its noble intentions, it fell far short of its transformative goals due to a combination of factors, including inadequate

resource allocation, a lack of contextual sensitivity, and an overly ambitious timeline (Tshimanika et al., 2022). These discrepancies highlight the importance of careful planning, stakeholder engagement, and realistic expectations in driving successful ICT integration in education.

While the urgency for schools to integrate ICTs has become an integral part in the education sector, Padayachee (2017) argues that there are South African public schools that have not been exposed or oriented into teaching with digital technology. These discrepancies between schools in the implementation of ICT integration have resulted in a digital divide gap amongst school outputs (Hart, 2023; Dzansi and Amedzo, 2014; Padayachee, 2017). The formulation of the ICT policy in education (White Paper on e-Education, 2004) over the past two decades should have helped bridge the digital divide. However, Vandeyar (2013) argues that this policy has not translated into widespread implementation in schools.

The 2015 adoption of the Sustainable Development Goals (SDGs) by all United Nations Member States established a global framework for action towards ending poverty, protecting the planet, and ensuring peace, prosperity, and quality education (SDG 4) for all by 2030 (United Nations, 2015; United Nations, 2021). These interconnected and indivisible goals emphasize the three pillars of sustainable development: economic, social, and environmental progress (UN, 2015; UN, 2021). Despite South Africa's commitment to achieving the SDGs (United Nations Summit, 2015), concerns arise regarding the pace of progress, particularly in education. Existing literature suggests that educational structures face numerous challenges, potentially hindering the equitable implementation of pedagogical ICT integration across schools (Ajani, 2023; Hart, 2023; Dlamini & Mbatha, 2018). Doubts remain regarding the effectiveness of efforts to prepare schools for such integration, as outlined in South Africa's ICT policy (EdTech, 2020; Padayachee, 2017; Vandeyar, 2013). Highlighting these concerns underscores the urgency of a comprehensive, system-wide approach to address challenges and facilitate the successful integration of ICTs in all South African schools. Given the transformative potential of ICT integration in education (Isaacs, 2007; Isaacs, 2020), this study delves into the practical realities of implementing such integration within South African schools.

1.2 Background

In response to the White paper on E-education (2004), various national ICT projects (Naicker, 2023; Isaac, 2007) have attempted to implement the policy. However, studies conducted on the implementation of the pedagogical integration of ICTs indicate that it is still at a low level (Maja, 2023; Ajani, 2023; Hart, 2023; Wilson-Strydom and Thompson, 2005; Blignaut, Hinostroza, Els, and Brun, 2010; Meyer and Gant, 2016). The studies report that ICT usage does not go beyond representation of analog content in digital form. The ICT in Education Policy (White paper on e-Education, 2004) that has been advocating the use of ICTs as early as 2004 states:

> "Learning using ICTs is arguably one of the most powerful means of supporting learners to achieve the nationally stated curriculum goals. It must however be very thoughtfully selected and integrated into educational planning and management. In particular, the use of ICTs for learning encourages learner-centred learning; active, exploratory, inquiry-based learning; collaborative work among learners and educators; and creativity, analytical skills, critical thinking, and informed decision making" (p19).

What is stated above in the policy is not translated into implementation at school level. Ibrahim Paneo et al, 2017 in Ajulor (2018) argue that "policy is only a good plan stored in the archive if it is not implemented correctly". It comes across as if the policy is just there for the sake of having a policy, but not much effort is put into actioning the policy; and in this case it becomes futile having a policy if it is not implemented (Matsieli & Sooryamoorthy, 2023; Vandeyar, 2013).

In September 2014, the Gauteng Department of Education outlined a 5-year project that aimed to ensure that all schools will be fully equipped with ICTs (Patel, 2018). Several years later, the President, Cyril Ramaphosa publicly endorsed this commitment in his State of the Nation Address (SONA: February 2019) that the Government would, over the next six years provide all South African schools with digital workbooks and textbooks on a tablet device. The political will is there to implement ICTs in schools, and this needs to be transformed into practice across schools. This outcome has not been achieved by most schools that have not engaged in the national and provincial ICT programs and has slowed down the rate of the implementation progress. (EdTech hub, 2020).

The existing ICT policy (White paper on e-Education, 2004) only recommends and advocates the use of ICTs in teaching and learning without specifying how it should be used. There are therefore limitations in the interpretation (Drenoyianni & Bekos, 2023; Ndlovu, 2015) and implementation of the policy (White paper on e-Education, 2004) to strengthen positive factors that promote creation of environments that endorse effective ICT pedagogical integration in schools. Hence the lack of advancement in its adoption and the unequal implementation between schools. The implication is that integration of ICTs is left to an individual school and there is no policy that binds educators to use ICTs in the classroom.

Given the notable disparities in the integration of ICTs within South African schools, this study aims to delve into the implementation of ICT policy in education and uncover the factors influencing its execution. These inconsistencies manifest in unequal access to teaching and learning opportunities. While some schools seamlessly transitioned to remote learning during the pandemic, others faced significant obstacles due to limited access to ICT resources, resulting in a complete halt to learning activities. This glaring disparity has spurred an inquiry into potential

strategies to prevent such discrepancies in the future, ensuring uninterrupted learning regardless of circumstances. The objective is to develop a framework that can level the playing field in education and bridge the digital divide among schools. To achieve this, the research is conducted across four schools, two in townships (one ICT and one non-ICT) and two in suburbs (one ICT and one non-ICT), all located within the Gauteng region.

In late 2014, the Gauteng Department of Basic Education (GDBE) launched a pilot e-learning project in a few province-wide schools to raise the bar for education in South Africa. This initiative, referred to as the "paperless classroom," sought to close the digital divide and improve educator competency in keeping with the e-learning vision stated in the South African ICT strategy (Department of Basic Education, 2013). The project entailed replacing conventional teaching supplies including chalkboards, pens, and textbooks with ICT equipment, such as tablets and digital screens, for both educators and learners. One noteworthy feature of the initiative was providing learners tablets with unrestricted 4G data connectivity, which greatly increased their access to educational materials. (Mokate, 2023; Minty & Moll, 2020; Kganyago, 2018; Msiza, Malatji & Mpahlele, 2020). Throughout this study, the term 'ICT school' specifically refers to these pilot schools participating in the Gauteng Department of Basic Education's e-learning initiative, whilst the non- ICT school refers to those schools that are not on this project. By exploring these diverse settings, the underlying discrepancies are highlighted, and a comprehensive framework is developed that can be applicable across various educational contexts to address this challenge effectively.

1.3 Problem statement

The integration of ICTs into South African schools faces numerous challenges, hindering the realization of its transformative potential in education. One significant obstacle is the inadequate infrastructure and resource allocation, particularly in resource-constrained schools (Ajani, 2023; Hart, 2023; Tshimanika, Chigona, & Sadeck, 2022). The lack of access to reliable internet connectivity, computers, and other ICT hardware limits the ability of schools to effectively implement ICT-based teaching and learning practices.

Furthermore, the lack of comprehensive and sustained educator training in ICT integration poses a major challenge (Rollnick, 2009; Lomo, Abonyi & Ahwireng, 2024). Educators often lack the necessary skills and knowledge to effectively utilize ICTs in their classrooms, hindering their ability to engage learners and enhance learning experiences (Tshimanika et al., 2022; Ajani & Govender, 2023). This gap in educator preparedness stems from insufficient training opportunities and a lack of ongoing support for educators in ICT integration. Moreover, the one-size-fits-all approach adopted in ICT integration policies fails to address the diverse needs and realities of different schools and communities (DoE, 2004). In addition, the ICT White Paper on e-Education

has not been revised since its unveiling in 2004, it remains the only ICT policy in education for the past two , decades, rendering it outdated and inadequate to address the environmental changes that have transpired since then. For instance, since the release of the South African ICT policy and the White Paper on E-education in 2004, only a small fraction of schools had reached the burgeoning stage of integrating ICTs into teaching and learning (Saal & Graham, 2023; Padayachee, 2017).

The top-down approach overlooks the varying levels of ICT readiness, infrastructure access, and educator expertise across the country, leading to implementation strategies that are not tailored to the specific contexts of individual schools (Tshimanika et al., 2022). Consequently, schools struggle to adapt ICT integration to their unique circumstances, hindering its effectiveness. ICTs had permeated modern societies, diffusing into nearly every aspect of human life. To maintain relevance. The schooling system must integrate ICTs into teaching and learning by transforming its pedagogical strategies. This will expose learners to experiences that embrace ICTs. This, in turn, would promote the reduction of the digital divide and support the participation of South African citizens in the economy (Siebörger, Terzoli and Hodgkinson-Williams, 2020).

1.4 Aim

The South African ICT White Paper on e-Education (2004) serves as a cautionary tale, demonstrating the pitfalls of inadequate resource allocation, a one-size-fits-all approach to ICT integration, and an overly ambitious implementation timeline. These shortcomings underscore the importance of careful visionary by school management, stakeholder engagement, educator participation in knowledge sharing and realistic expectations in driving successful ICT integration in education. This research explores how resource allocation and standardized pedagogical approaches shape the implementation of ICT integration in schools. Drawing from participants' experiences, the aim is to develop a transformative conceptual framework/model for effective ICT integration in South African schools that addresses the limitations of past one-size-fits-all approaches, uneven resource distribution and instructional uniformity. This framework will be informed by lessons learned from diverse school settings (ICT and non-ICT schools) and aim to foster deeper learner engagement and knowledge construction, thereby enhancing learning outcomes across diverse educational contexts.

1.5 Research objectives.

- To identify potential drawbacks and limitations of the one-size-fits-all approach in the context of ICT.
- To identify and analyze the challenges and limitations associated with implementing a standardized ICT integration approach across diverse educational contexts.

- To develop a framework for transformative ICT integration in education that caters to diverse school environments, based on the analysis of successful implementations

1.6 Research question

What are the key opportunities that can transform the implementation of ICT pedagogical integration in South African schools?

1.6.1 Sub-questions

1. How did the one-size-fits-all approach to ICT integration affect the success of ICT implementation in selected ICT and non-ICT South African schools?
2. What are the potential drawbacks and limitations of the one-size-fits-all approach in the context of ICT implementation?
3. What framework can be effective for the transformation of ICT integration in education, drawing from the lessons learned from the sampled schools?

1.7 Rationale

As the problem statement highlighted, the South African government had invested heavily in ICT infrastructure for educational purposes. Despite efforts to prepare school stakeholders for the change associated with adopting these technologies, research reports continued to reveal shortcomings in the realization of the benefits of these resources (Pan African Research Agenda, 2008-2012; Padayachee, 2017; Monareng et. Al., 2020). While the CAPS (DoE, 2011) and the ICT policy (DoE, 2004) reflected the constitutional obligation to achieve equity and equality in resource distribution and utilization, there appeared to be a disconnect between policy and practice. This study delves into the experiences of schools as they implement the pedagogical integration of ICTs, with the aim of uncovering both challenges and opportunities. By conducting research in both township and suburb ICT and non-ICT schools, a comprehensive understanding of the educational landscape emerges, offering valuable insights for various purposes. This approach enables the examination of educational disparities by comparing access to ICT resources and opportunities across different school settings, thereby contributing to the formulation of policies aimed at reducing inequalities. Furthermore, by investigating the integration of ICT into school curricula, the study sheds light on its impact on teaching and learning outcomes, informing strategies to improve educational practices. Comparative research findings provide evidence-based insights for policymakers and educators, aiding in the development of tailored interventions to address the specific needs of schools in diverse contexts, thereby enhancing overall educational quality. Additionally, understanding the challenges faced by schools in various socio-economic contexts informs efforts to foster inclusive educational environments, ensuring equitable opportunities for all learners. Finally, examining ICT integration in schools serves to prepare

learners for future careers by aligning educational practices with the demands of the 21st-century workforce.

Subsequently, the findings informed the development of a comprehensive ICT framework tailored for successful implementation across all South African public schools and other stakeholders in the education system irrespective of geographical location. The successful implementation of ICTs in South African public schools' hinges on a comprehensive framework that addresses infrastructure, educator preparedness, context-sensitivity, stakeholder engagement, policy guidance, evaluation, pedagogical utilization, research, and innovation. Equitable access to ICT infrastructure, comprehensive educator training, and tailored strategies to diverse school contexts are crucial. Engaging school leaders, educators, and parents fosters collaboration and knowledge sharing. A robust ICT policy framework provides clear goals, strategic planning guidelines, and continuous evaluation mechanisms. ICT-enhanced pedagogies, improved learner engagement, and critical thinking skills are key to effective teaching and learning. Supporting ICT research and development, along with knowledge sharing, drives innovation and informs ICT integration efforts across schools. This holistic approach empowers educators and transforms teaching and learning for all learners.

1.8 **Chapter Outline**

Chapter 1: Introduction and Background of the Study

This chapter provides an introduction and background to the challenges of implementing ICT pedagogical integration in South African schools. Despite being on the cusp of the Fourth Industrial Revolution, many schools struggle to effectively integrate ICTs into their educational practices. This study delves into the practical realities of ICT implementation within diverse South African school environments. It aims to identify factors that hinder or facilitate successful integration, ultimately informing the development of more effective strategies for using ICTs in education

Chapter 2: Literature Review

This chapter delves into the existing research on the opportunities and affordances presented by pedagogical ICT integration in teaching and learning. The global landscape of ICT use in education is explored, examining the extent of its implementation across diverse contexts. The review also critically examines the challenges associated with ICT integration, including resource limitations (infrastructure, financial), professional development gaps (technical skills, pedagogical knowledge), and policy inconsistencies.

Drawing on the theoretical framework employed by Collis and van der Wende (2002), the chapter then examines a specific study that investigated the use of ICT for pedagogical purposes in South

African schools. This framework served as a lens to explore the key opportunities for improving ICT integration within this specific context. By applying this theoretical perspective, the research sheds light on the nuanced challenges and opportunities faced by South African schools as they strive to implement pedagogical ICT integration effectively.

Chapter 3: Research Design and Methodology

In this chapter, the chosen research methods for a qualitative study examining the integration of ICT in South African schools are outlined and their suitability justified. The methodology focuses on a case study approach involving interviews with educators and school leaders from four schools. Emphasizing an interpretivist perspective, the research aims to explore how individuals perceive and experience ICT integration within their social contexts, aiming to capture lived experiences and understand the social construction of these experiences in a specific educational setting.

Chapter 4: Data presentation and results

This chapter presents and interprets the data collected from the 16 participants, including 12 educators and 4 school managers. Emerging themes are then identified and grouped for further analysis.

Chapter 5: Data analysis and findings

This chapter analyzes data from the 16 educators and managers in the diverse South African schools. Following data cleaning and reduction, key themes were identified that explored factors influencing successful ICT integration. By transforming the data into meaningful insights, this chapter answers the research questions and interprets the findings in the context of existing research. This analysis highlights both challenges and opportunities for utilizing ICTs effectively in South African education

Chapter 6: Discussion

This chapter engages in a critical discussion of the findings presented in Chapters 4 and 5. It explores the key themes and insights that emerged from the research, with a specific focus on factors that influence the successful implementation of pedagogical ICT integration within South African schools.

Chapter 7: Conclusion and study implications

This chapter concludes the study by reflecting on its overall findings. It summarizes the key insights that address the main research question regarding successful ICT integration in schools. A novel model or framework is then proposed, outlining components and strategies to support

effective implementation. Finally, the chapter discusses the study's contribution to the field, acknowledges its limitations, and presents recommendations for future research.

Chapter Two: Literature Review

2.1 Introduction

This study navigates the multifaceted landscape of ICT integration in education through a comprehensive and systematic literature review. A wide range of academic and professional sources encompassing digital and print domains were meticulously examined. Section 2.2, The search employed key terms like ICTs, ICT integration, pedagogical integration of ICTs, and ICT policy implementation to gather diverse perspectives on the topic. This rigorous exploration provided crucial context for formulating research questions and laying the foundation for the investigation. Subsequent sections delve deeper into specific aspects of ICT integration within educational contexts. Section 2.3, The first step entailed establishing the fundamental rationale driving the adoption of ICTs in educational frameworks. This rationale serves as a cornerstone, framing the exploration of ICT implementation across diverse settings. By meticulously analyzing the motivations and justifications for ICT integration, we lay the groundwork for a nuanced examination of its multifaceted dimensions and implications within the learning domain. This systematic approach aims to illuminate the diverse factors influencing ICT adoption, revealing the overarching goals and expectations associated with its integration into educational practices. This groundwork facilitates a deeper and contextually aware understanding of the diverse applications, challenges, and potentials inherent in the broad implementation of ICTs in educational settings.

Acknowledging the importance of a global perspective, the study transcends geographical boundaries. Section 2.4, We draw insights from research conducted in both developed and developing countries to explore the multifaceted dimensions of ICT policy implementation. This comparative approach recognizes that intentions often encounter varying challenges and outcomes in distinct educational landscapes. By incorporating diverse perspectives, we aim to enrich our understanding of the complexities inherent in translating policy intentions into effective practices, discerning patterns, challenges, and successes beyond specific regional contexts. This endeavor seeks to contribute valuable insights to the global discourse on ICT in education, fostering a nuanced understanding that transcends local boundaries and offers a more holistic view of the implementation process in the realm of educational technology policies. Recognizing the need for in-depth analysis, distinct sections focus on the implementation of ICTs within both developed and developing contexts. Section 2.5 examines the nuanced dynamics, challenges, and achievements characterizing technologically advanced educational environments in developed settings. Concurrently, Section 2.6 scrutinizes the distinct landscape of ICT implementation in developing contexts, where diverse socio-economic, infrastructural, and pedagogical considerations contribute to a unique set of challenges and opportunities. This intentional division facilitates a comprehensive analysis that recognizes the contextual intricacies influencing ICT

adoption and implementation in education, enriching our understanding of the global implications and tailored strategies essential for effective technology integration across varied educational landscapes.

Having established the essential components of successful ICT integration, Section 2.7 delves into the critical factors influencing its effective implementation at both the school and educator levels. Section, 2.8 dissects the multifaceted realities of school and classroom environments, identifying key variables that contribute to or impede the implementation of ICT pedagogical integration in schools. Subsequently, Section 2.9 solidifies the theoretical foundation of this investigation by presenting the comprehensive conceptual framework that will guide the exploration throughout the remaining chapters. This framework serves as a vital scaffolding, ensuring a cohesive and insightful examination of the intricate dynamics underpinning successful ICT implementation in education.

2.2 Key terminology

Delving into the intricate web of terms and concepts that will guide our exploration of the implementation of ICT pedagogical integration, we begin by precisely defining the key players. 'ICT' itself encompasses the interwoven network of technologies facilitating information creation, manipulation, storage, transmission, and retrieval. 'ICT integration', then, refers to the purposeful incorporation of these technologies into teaching and learning practices. But within the specific scope of this study, 'ICT pedagogical integration' takes on a nuanced meaning, informed by the unique challenges and opportunities shaping education in these settings. Each definition is carefully crafted through this lens, paving the way for a deeper understanding of the intricacies at play.

2.2.1 Information Communication and Technology (ICT)

Stepping into the realm of technology, we encounter ICT, encompassing not just computers and multimedia but also the web of connections that bind them. ICTs encompass the vast array of hardware and software tools that enable the creation, manipulation, storage, transmission, and retrieval of information. ICTs include a wide range of technologies, such as computers, smartphones, tablets, laptops, the Internet, software applications, multimedia tools, and digital communication devices (Yahaya & Bolaji, 2023). These technologies are interconnected and interdependent, forming a complex ecosystem that enables the flow of information and communication. The convergence of these technologies has led to the emergence of new forms of ICTs, such as cloud computing, artificial intelligence, and the Internet of Things (IoT) (Ajani & Khoalenyane, 2023; Heeks, 2002). ICTs permeate every aspect of modern life, from education and healthcare to business and entertainment. They have revolutionized the way we communicate,

learn, work, and play, fundamentally transforming societies around the globe (Ajani et al., 2024; Castells, 1996).

In the educational context, ICT encompasses a broad spectrum of ICTs, encompassing tools such as radio, television, cell phones, tablets, computers, hardware, software, networking systems, and other devices (Minga & Ghosh, 2024; Annan, 2005; Tinio, 2002; Kumar, 2008; Lloyd, 2005). These technological entities collectively facilitate information processing, communication, and the transmission of knowledge within the framework of teaching and learning. ICTs have emerged as potential catalysts for a revolutionary transformation in education, with the capacity to elevate teaching and learning practices, broaden access to educational resources, and cultivate global collaboration. The integration of ICT in education yields a myriad of advantages. Firstly, it enhances learning engagement by making the educational experience more interactive and stimulating, capturing learners' attention, and fostering active participation (Bahiya, 2023; Prensky, 2001; Cuban, 2001). Additionally, ICT facilitates personalized learning experiences, tailoring instruction to meet individual learner needs and learning styles (Rana, 2023; Baker, 2005; Herrington & Mishra, 2004). It also improves access to information by providing learners with a vast array of educational resources, including online databases, libraries, and software, extending their exposure to knowledge beyond conventional textbooks (Wyatt, 2024; Warschauer, 2006; Oliver & Herrington, 2001). Moreover, ICT fosters collaboration and communication among learners, both within and beyond the classroom, promoting peer learning and global connections (Balol, 2023; Harasim, 1996; Weger, 1991). The integration of ICT in education also plays a pivotal role in developing digital literacy skills, preparing learners for the demands of a technology-driven world (Rumnong & Kharbirymbai, 2023; Gilster, 2000; Moss, 2004).

However, this transformative potential is accompanied by challenges. A significant concern is the digital divide, where unequal access to ICT resources and infrastructure exacerbates existing educational disparities, creating a divide between learners from different socioeconomic backgrounds (Dlamini & Dewa, 2021; Warschauer & Healey, 1998; van Dijk, 2005). Furthermore, effective ICT integration necessitates educators to possess robust digital literacy skills and pedagogical knowledge to utilize these tools meaningfully in the classroom (Lomo et al., 2024; Kwatubana & Mtimkhulu, 2024; Cuban, 2001; Penuel, 2006). There is also a risk of overreliance on technology, potentially hindering the development of critical thinking and problem-solving skills, as learners may overly depend on technology for information and learning (Prensky, 2001; Cuban, 2001).

Despite these challenges, ICT remains a potent force in transforming education, offering opportunities to enhance teaching, and learning practices, broaden access to knowledge, and

prepare learners for the evolving demands of the 21st century. As ICT continues to evolve, its role in education is poised to become even more significant, shaping the future landscape of teaching and learning.

2.2.2 ICT Integration

ICT integration, though acknowledged by Lloyd (2005) as challenging to define due to varying interpretations, encapsulates a transformative shift in pedagogical practices. Lloyd describes it as a movement towards making ICT an indispensable component of learner learning, rather than a peripheral tool (p. 5). Annan (2005) & Abedi (2023) echoes this interpretation, defining ICT integration as the seamless incorporation of ICTs into teaching and learning to enhance educational outcomes. Strydom and Thomson (2005) further elaborate on the concept of integration, differentiating between adoption (basic use of ICTs for planning, internet access, and administration by educators) and adaptation (advanced use promoting interactive learning in the classroom).

The literature consistently indicates widespread adoption of ICTs in schools (PanAf, 2008; Vandeyar, 2013; Strydom & Thomson, 2005; du Plesis & Webb, 2012; Padayachee, 2017; Dlamini & Mbatha, 2018; Reinking, 2010; Blignaut, 2010; Ndlovu & Moll, 2016; Kozma et al., 2011; Ed Tech Hub, 2020; GOLA, 2020; World group Covid, 2020). However, the emphasis is shifting towards adaptation, placing a greater focus on interactive learning that empowers learners to construct their own knowledge (Papert, 1989 in Lloyd, 2005). This alignment with the evolving landscape of emerging technologies underscores the importance of high-level ICT integration, as advocated for in the White Paper on e-Education (2004); the Guidelines for Educator Training and Professional Development in ICT (2007); Strategy for information and communication technology in education framework (2014) and Enhancing ICT readiness of schools in South Africa (2021).

In this context, ICT integration is not merely about incorporating technology into the classroom; it is about fundamentally rethinking and transforming the teaching and learning process to harness the transformative power of ICTs. It entails moving beyond the superficial use of ICTs as tools for presentation or delivery of content and towards leveraging ICTs to create engaging, interactive, and collaborative learning environments that foster critical thinking, problem-solving, and higher-order cognitive skills.

Effective ICT integration requires a holistic approach that encompasses not only the availability of ICT resources and infrastructure but also the professional development of educators to develop the necessary pedagogical knowledge and skills to effectively utilize ICTs in their teaching practices.

It also necessitates a supportive school culture that encourages innovation, experimentation, and the adoption of ICTs as integral components of the teaching and learning process.

In conclusion, ICT integration represents a paradigm shift in education, moving towards a future where ICTs are not just tools but rather catalysts for transformative learning experiences that empower learners to become self-directed, lifelong learners, equipped to navigate the complexities of the 21st century.

2.2.3 ICT Pedagogical Integration

ICT Pedagogical Integration represents a transformative process in education, involving the infusion of ICTs into the curriculum to establish an interactive and learner-centered environment. This approach, as advocated by the Guidelines for Educator Training and Professional Development (2007), empowers learners to construct their own knowledge. Studies by Padayachee (2017), Moeketsi & Chigona (2014), Assan & Thomas (2012), Tamin et al. (2015), Nthooa (2017) and Lomos et al. (2023) highlight the diverse range of ICTs and web applications employed in teaching, including PowerPoint presentations, virtual meetings, data projectors, interactive whiteboards, emails, tablets, and more. However, the effective integration of ICTs requires more than their mere use, as emphasized by Tamin et al. (2015) and Padayachee (2017). The misconception that technology use alone ensures educational transformation underscores the necessity for in-depth knowledge of technologies to facilitate pedagogical and content knowledge.

Despite educators using ICTs for various activities, pedagogical integration into content remains insufficient due to a lack of understanding, knowledge, and skills in technology integration, as observed by Nthooa (2017). The goal of ICT integrative learning is to advance toward the pedagogical integration of ICTs, signifying a paradigm shift from traditional teaching methods (Ajani, 2023; UNESCO, 2002; ACOT, 1995). This shift aims to create a collaborative and learner-centered environment, promoting knowledge construction and higher-order thinking skills in the learning process.

ICT Pedagogical Integration in contemporary classrooms involves purposeful utilization of ICTs to enhance teaching and learning practices, surpassing the mere incorporation of tools into lessons. Drawing from Cuban (2003) and Hew & Brush (2007), it requires designing learning experiences that capitalize on ICTs' unique affordances to foster active engagement, collaboration, critical thinking, and problem-solving. This shift demands moving from traditional educator-centered instruction to learner-centered approaches, empowering learners to take ownership of their learning process, as suggested by Cuban (2003). ICTs facilitate learner-led inquiry, peer-to-peer

learning, and personalized learning experiences tailored to individual needs and learning styles, aligning with the insights of Adams Becker et al. (2013).

Moreover, ICTs play a crucial role in enhancing communication and collaboration among learners, educators, and parents. Johnson et al. (2015) and Kaur (2023) notes that online platforms, virtual learning environments, and social media tools enable seamless communication, resource sharing, and collaborative project work, fostering a connected learning community. Additionally, ICTs provide access to a vast array of digital resources, including multimedia content, interactive simulations, and online learning modules, enriching the curriculum, and expanding the scope of learning beyond traditional textbooks (Lomos et al., 2023; Hew & Brush, 2007). Furthermore, ICTs facilitate access to global networks, fostering intercultural understanding and global citizenship (Enebeli, 2024; Warschauer & Healey, 1998).

Effective ICT Pedagogical Integration goes beyond using technology for its own sake; it involves leveraging the transformative power of ICTs to reimagine teaching and learning, empower learners, and equip them for the demands of the 21st century, in alignment with the insights of Prensky (2001)

2.3 Rationale for ICT pedagogical integration

The impetus for integrating ICTs into pedagogy stems from an extensive examination of its pedagogical potentials and a meticulous scrutiny of educators' perspectives concerning its substantive role within the classroom environment. At its core, the appeal of ICT is underpinned by perceived economic benefits on a global scale, leading many nations to embrace it as a transformative force to keep pace with the modern world. This pervasive belief in ICT's potential has resulted in diverse applications influenced by contextual factors, available technology options, and pedagogical needs. The pursuit of the Millennium Development Goal (MDG) of creating a knowledge-based economy further amplifies this global phenomenon, as reflected in national policies categorized by Hafeez, Akram and Nazir (2023) & Voogt (2008) into three distinct rationales: the Social Rationale, emphasizing responsible citizenship and bridging the digital divide; the Vocational Rationale, focusing on equipping learners for future jobs and fostering employability; and the Pedagogical Rationale, centered on enhancing teaching and learning outcomes through technology. The social imperative underscores the belief that ICT empowers individuals and societies, playing a pivotal role in global socio-economic development. The evolving paradigm of ICT's societal benefits aligns with the goal of achieving a knowledge-based economy and holds implications for job creation and poverty alleviation. The vocational rationale, closely tied to the social imperative, posits that acquiring ICT skills expands job opportunities and fosters self-sufficiency. However, measuring the actual impact of ICT on livelihoods remains a

subject of ongoing debate, with nations facing pressure to be internationally competitive to fully utilize ICT's potential. The pedagogical promise of ICT, seen as transformative for teaching and learning, has garnered compelling support over the years. Arguments for integration include the potential to improve learner outcomes, enrich curricula, enhance pedagogy, and support educator development, as summarized by (Abedi, 2023; Hinostroza, Labbé, López, & Iost, 2008). Yet, challenges and critiques persist, with (Voogt, 2008) highlighting the gap between intended and actual implementation, and (Matsieli & Sooryamoorthy, 2023; Plomp, Anderson, Law & Quale, 2009) emphasizing the complexity of integrating ICT into education, citing technical demands and a limited research base. These multifaceted dynamics underscore the intricate landscape of ICT integration in education, necessitating a nuanced exploration of its implications and challenges.

2.3.1 The Interplay of Knowledge, Integration, and Implementation in ICT Practice

Education stands at a crossroads, with ICTs emerging as a potent force reshaping classrooms across the globe. This section delves into the intricate nexus of knowledge, integration, and implementation that underpins effective ICT utilization in schools.

2.3.1.1 ICT Knowledge

Educators' proficiency in ICT is instrumental for its effective integration into the learning environment. The concept of "knowledge" in this context is multifaceted, as proposed by Mishra and Koehler (2006) and espoused by Celik (2023) through their Technological Pedagogical and Content Knowledge (TPACK) framework. This framework intricately examines the interplay between three essential components:

- ***Content Knowledge:*** A foundational grasp of the subject matter being taught is crucial. Educators must confidently navigate the specific concepts and skills within their discipline to meaningfully leverage ICT in their instructional practices, as emphasized by Shulman (1986).

- ***Pedagogical Knowledge***: Deep comprehension of effective teaching approaches and strategies enables educators to adapt and enhance their existing instructional practices through the integration of ICT tools, as noted by Shulman (1986).

- ***Technological Knowledge:*** Proficiency in operating and troubleshooting various ICT tools and platforms establishes the groundwork for their seamless integration in the classroom, a key aspect highlighted by Mishra and Koehler (2006).

Beyond these fundamental components, scholars such as Celik (2023) and Voogt (2003) emphasize the significance of critical knowledge. This involves enabling educators to evaluate the

merits and limitations of different ICT tools and their alignment with learning objectives. Additionally, Roblyer (2016) advocates for transformative knowledge, fostering an understanding of how ICT can fundamentally reshape teaching and learning experiences. This comprehensive perspective on educators' ICT knowledge underscores the diverse dimensions that contribute to their proficiency in integrating technology effectively into the educational setting.

2.3.1.2 Integration and Implementation in Education

Achieving effective integration of ICTs in educational settings transcends mere knowledge acquisition, demanding the translation of expertise into action and the seamless infusion of technology into the daily fabric of classroom experiences. This integration spans a spectrum of manifestations, encompassing simple drill-and-practice exercises to intricate simulations and collaborative projects.

Numerous conceptual frameworks exist to illuminate the complexities of ICT integration. For instance, Couch (2023) & Sammons et al. (2008) propose a continuum, ranging from substitution, where ICT replicates traditional pedagogies, to redefinition, where technology fundamentally transforms learning experiences and learner interactions. Augmentation and modification occupy the intermediate space, representing incremental enhancements and adaptations of existing practices.

The dynamic process of selecting an appropriate level of integration is influenced by factors such as educators' knowledge, available resources, and learner needs. Regardless of the specific approach, effective integration demands intentional alignment between selected ICT tools, intended learning objectives, and the broader pedagogical vision (Williams, Christensen & McElroy, 2023; Voogt, 2003).

The successful integration of ICT into school environments requires adept navigation of a multifaceted ecosystem of factors. Visionary school leadership, as emphasized by Fullan (2001), is pivotal, underscoring the need for leaders to prioritize ICT integration and provide sustained support for professional development to ensure success. Foundational to this success is infrastructure, encompassing reliable access to hardware, software, and a robust internet connection, echoing the insights of (Ajani, 2023; Hart, 2023 & Voogt, 2003). Curriculum alignment, as highlighted by Ilic (2024) & Cuban (2001), is equally crucial, necessitating the revisiting and adaptation of curricula to leverage technology's affordances while ensuring alignment with learning objectives. Moreover, fostering a school culture that encourages experimentation, collaboration, and innovation is essential for the exploration and adoption of new ICT-based pedagogical practices, as noted by Schmidt (2024) & Fullan (2001). In navigating this intricate landscape, attention to leadership, infrastructure, curriculum alignment, and school

culture emerges as integral components for the successful integration of ICT into the educational environment.

The journey toward successful implementation also requires addressing potential challenges, including educator anxieties regarding technology, limited professional development opportunities, and insufficient access to resources. Overcoming these hurdles necessitates a multifaceted approach that combines top-down leadership initiatives with bottom-up educator empowerment and collaborative support networks.

2.3.1.3 Implications for Practice in ICT Integration in Education

Delving into knowledge, integration, and implementation, an intricate terrain of ICT in schools is revealed. Key areas for supporting educators' ICT integration across diverse contexts, including their knowledge needs and gaps is analyzed. Additionally, it prompts the identification and scaling up of successful models of professional development aimed at equipping educators with the requisite knowledge and skills for effective technology integration. Moreover, the exploration encourages the development of adaptable strategies for navigating challenges inherent in the implementation process, encompassing resource limitations, educator anxieties, and other potential barriers. By comprehending the interplay between knowledge, integration, and implementation, this study aspires to pave the way for the effective utilization of ICT in schools. A transformative trajectory is envisioned, wherein classrooms metamorphose into vibrant learning spaces, with technology assuming the role of a powerful catalyst for knowledge construction, collaboration, and critical thinking.

2.3.1.4 General use of ICTs in schools

This section provides a synthesis of the general use of ICT in education, featuring an adapted model of innovative ICT applications tailored to the focus of this study. The objective is to classify educators based on their utilization of ICT, thereby facilitating an in-depth investigation into the varied implementations of ICT in educational settings.

The potential of ICT to enhance teaching and learning is substantial. However, as Ainley, Enger, and Searle (2008) & Nettey, Mensah, Asafo-Adjei and Babah (2024) highlight, there exists a current lack of comprehensive understanding regarding the diverse ways in which ICT is employed in schools globally. Statistical insights from the SITES 2006 study emphasize an increasing trend in ICT usage; nevertheless, for most educators, its application remains confined to the peripheries of the educational process (Dlamini & Zenda, 2023; Plomp, Pelgrum & Law, 2008). Recognizing this, it becomes imperative for national policies to explicitly delineate the roles of ICT in schools and classrooms. Kwatubana (2023); Moosa, Ncube and Ramnarain (2023)

& Ainley et al. (2008) emphasize the need for clarity in national policy documents to guide stakeholders in appropriate resource allocation.

Furthermore, Kozma (2008) argues for the incorporation of a strategic educational ICT policy framework within national policies. This framework, according to Kozma, serves as a guide for decision-making related to ICT use, ensuring that efforts of educational stakeholders remain aligned. Without a strategic rationale, there is a risk of divergence in these efforts, potentially hindering the effective integration and utilization of ICT in education.

Additionally, (Kozma, R., & McGhee, R, 2003) contribute a model for the classification of ICT uses, offering a valuable framework for understanding the varied applications of ICT in educational contexts. This comprehensive overview sets the stage for the subsequent exploration of how science educators employ ICT, aiming to contribute nuanced insights to the broader discourse on ICT integration in education. Table 1 illustrates a modified framework that illustrates various ways ICTs are being utilized in the educational context.

Table 1: Ways ICT used at schools- Source: Adapted from Kozma and McGhee (2003)

Pattern	**Characteristics**
1. Instrumentation	Educators engage in activities such as utilizing email, generating documents, conducting information searches, word processing, and creating multimedia content.
2. Data administration	Educators employ ICT tools to organize, manage, and leverage information for teaching and learning purposes, as well as to effectively present information to learners
3. Educators' synergy	Involvement of educators collaboratively designing instructional materials or activities using ICT platforms
4. Content Development	Educators participate in designing and crafting digital products using various software packages, showcasing a creative application of ICT in educational content development.
5. Assignments or activities	Educator utilizes lessons or drill-and-practice software, providing learners with opportunities to work independently on instructional projects.

A comprehensive understanding of the general use of ICT assumes a critical role within the context of this thesis, particularly given the limited specific insights into how educators utilize ICT at the classroom level in South African schools. In alignment with the views expressed by Moosa et al. (2023) & Anderson and Plomp (2009), the researcher asserts that decisions pertaining

to ICT implementation should be informed by research outcomes tailored to the distinct educational goals of South Africa. While recognizing the universally applicable ICT uses delineated by Kozma and McGhee (2003), it is acknowledged that these applications resonate globally, including in South Africa. However, acknowledging their global applicability does not inherently imply seamless applicability to the South African context. Instead, these identified uses serve as a valuable reference point, prompting South Africa to contemplate potential adoption strategies. This nuanced perspective emphasizes the imperative for context-specific considerations and adaptations when leveraging ICT for educational advancement in South Africa, thereby aligning with the broader objectives outlined in the national ICT policy.

2.4 ICT policy landscape

Recognizing the limitations of a one-size-fits-all approach, this section emphasizes the need for context-specific ICT policies that effectively address the diverse challenges and opportunities within South Africa's educational landscape.

The exploration of ICT policy implementation in South Africa constitutes a complex and dynamic landscape, necessitating a meticulous and comprehensive examination. In this chapter, we undertake this exploration, navigating the intricate terrain with the guidance of a thoughtfully curated constellation of enlightening sources.

However, our expedition extends beyond the influence of these prominent figures. We embrace the expansive sea of diverse perspectives found in the broader literature. By delving into the experiences of other nations and their encounters with ICT in public schools, we gain valuable insights that enhance our understanding of the specific challenges and opportunities unique to the South African context. Through this thorough and discerning analysis, our objective is not only to dissect the current state of ICT policy implementation but also to navigate a trajectory toward a more efficient and equitable future for technology in South African education.

2.4.1 Essential components and considerations in effective ICT policies for education

While the transformative potential of ICT in education is readily acknowledged, its effective implementation remains fraught with complexities. As Ainley, Enger, and Searle (2008) point out, a "dearth of understanding" surrounding diverse ICT uses persists globally. Despite a documented rise in ICT adoption ((Dlamini & Zenda, 2023; Plomp, Pelgrum & Law, 2008), many educators still relegate it to the margins of their teaching repertoire. This disconnect underscores the critical need for strategic frameworks that guide informed decision-making and ensure coherence in ICT integration.

Kozma (2008) underscores the significance of purpose-driven ICT policy frameworks, emphasizing their role in providing clear direction to stakeholders. These frameworks not only

guide judicious resource allocation but also ensure alignment with overarching educational goals. The absence of such strategic guidance poses the risk of fragmented efforts and suboptimal outcomes. Therefore, the establishment of a comprehensive and strategic framework becomes imperative to effectively harness the transformative potential of ICT in a coherent and impactful manner.

The effective utilization of ICTs on a global scale has demonstrated its capability to bring about substantial transformations in teaching and learning methods, elevate academic outcomes, and address the digital divide. For instance, Singapore's implementation of the "IT Masterplan" by the government has been instrumental in integrating ICTs into the educational landscape, resulting in significant improvements in learner literacy and numeracy scores (Tan, 2014). Similarly, Finland's "National Strategy for Information and Communication Technology in Education" has created an environment fostering ICT innovation in schools, leading to increased learner engagement, and facilitating active learning (Pelkonen et al., 2015). Additionally, Estonia's "Tiger Leap" initiative has ensured widespread access to ICTs for both learners and educators, contributing to a highly digitized education system and exceptional learner performance in international assessments (Kadakas & Klemm, 2023; Riis, 2011). These examples highlight the transformative effectiveness of judiciously implemented ICTs, aligning with overarching national educational objectives and catering to the unique needs of diverse educational communities.

In South Africa, where resource disparities and infrastructure limitations are prevalent, a successful ICT policy implementation must prioritize equitable access to ICT resources across schools. This requires a comprehensive assessment of ICT infrastructure needs, including access to reliable internet connectivity, computers, and other essential hardware. Targeted funding should be allocated to resource-constrained schools, particularly those in rural and underserved areas, to bridge the digital divide and ensure that all learners can engage in ICT-enabled learning. In addition to hardware, schools also require adequate funding for software, training, and ongoing technical support. A sustainable ICT budget should be established to cover these expenses and ensure that ICT integration initiatives are not hindered by resource constraints. Furthermore, the policy should outline clear guidelines for procurement and maintenance of ICT resources to maximize their lifespan and utilization (Tshimanika, Chigona, & Sadeck, 2022).

The one-size-fits-all approach to ICT integration has often proven ineffective in South African schools due to the diverse needs and realities of different school communities. A good ICT policy should emphasize a context-sensitive approach, tailoring ICT integration strategies to the specific circumstances of each school. This involves considering factors such as school size, location, learner demographics, educator expertise, and existing infrastructure. Schools should be

empowered to develop their own ICT integration plans based on their unique context and needs (Monareng et al., 2020). A critical imperative emerges for national policies to clearly define the roles of ICT within schools, explicitly outlining its intended purposes to provide transparency for educational stakeholders. Communicating the objectives of ICT use in national policy documents, as emphasized by Kwatubana (2023); Moosa, Ncube and Ramnarain (2023) facilitates the judicious allocation of resources and efforts. Successful ICT implementation in South African schools necessitates active engagement of stakeholders, including school leaders, educators, parents, and learners, throughout the planning, execution, and evaluation of integration initiatives. School leaders, playing a pivotal role, set the vision for ICT integration, provide essential resources, and foster a supportive environment. To effectively integrate ICTs into teaching practices, educators require comprehensive and ongoing professional development (Park & Kwon, 2023; Rollnick, 2009). Involving parents in the ICT integration process is crucial for understanding the benefits and supporting their children's ICT use at home. Likewise, learner engagement in the process ensures their voices are heard, aligning ICT tools and resources with their learning needs and interests.

Regular evaluation and monitoring are essential for assessing the effectiveness of ICT integration initiatives in South African schools. A robust evaluation framework should be established to measure the impact of ICTs on learner learning, educator practices, and overall school performance. Clear metrics and data collection methods should be employed to gather evidence-based insights into the effectiveness of ICT integration strategies. Evaluation findings should be used to inform ongoing professional development, adapt ICT integration strategies to better meet the needs of diverse learners, and allocate resources more effectively (Ndlovu, 2016; Padayachee, 2017).

Continuous improvement is essential for ensuring that ICT integration remains aligned with the evolving needs of the school community and the ever-changing landscape of technology. South African schools should adopt a culture of continuous evaluation and improvement, regularly assessing the effectiveness of their ICT integration initiatives and making necessary adjustments to maximize the benefits of ICTs for teaching and learning. Recognizing these challenges, many countries have developed national ICT policies to guide implementation. These policies can range from global and cross-national initiatives to national and even school-level plans. However, as Moosa et al., (2023); Cecchini and Scott (2003); & Kozma (2008) emphasize, simply having policies in place is not enough. Effective ICT integration requires a clear developmental strategy, outlining a vision and roadmap for achieving specific goals (Naidoo and Rasoo, 2024; Law, 2009). This necessitates engaging school leadership through school-level policies that empower them to tailor implementation to their unique contexts and strive for quality education.

2.4.2 The role of ICT policy in transforming education systems

The history of ICT in education reveals a fascinating trajectory, moving from grand social and economic aspirations to a growing focus on its pedagogical potential. The integration of ICTs in education is widely recognized as a critical driver of transformation, promising to enhance learner achievement, improve accessibility, strengthen infrastructure, equip learners for global competitiveness, foster knowledge creation, and facilitate global engagement (DoE, 2004). This convergence of societal, economic, and educational imperatives has prompted policymakers to frame ICT policies around a nation's vision for leveraging educational technology to achieve economic growth and social progress (Moosa et al., 2023; Kwatubana, 2023; Vandeyar, 2013; Kozma et al., 2011; Rubagiza, et al., 2011, DoE, 2004). South Africa's educational technology landscape has witnessed continuous evolution through ongoing policy reviews and revisions, commencing with the 2004 Draft White Paper on e-Education and culminating in the 2021 "Enhancing ICT Readiness of Schools" initiative. This iterative process, punctuated by the National ICT in Education Policy (2004) and the Strategy for Information and Communication Technology in Education (2014), underscores the nation's persistent commitment to optimizing ICT integration within teaching and learning practices. However, the National ICT in education policy “White paper on e- Education (2004)” remains the latest ICT policy in South Africa.

2.4.2.1 The 2004 draft white paper on e-Education

The draft paper on e-education marked a pivotal moment in South Africa's educational landscape. This pioneering document laid the foundation for ICT integration, aiming to create an "inclusive, equitable, and efficient education system" through ICT. It emphasizes learner-centered, outcomes-based education and educator training as crucial components. (DoE, 2004). Its vision transcended mere computer literacy, aiming to democratize access to knowledge, cultivate critical thinking and collaboration skills, and enhance the overall quality of education. To achieve this, the White Paper championed five key pillars: developing the necessary infrastructure and resources, empowering educators with ICT proficiency, integrating technology into curriculum and pedagogical practices, establishing robust monitoring and evaluation mechanisms, and fostering community participation in educational reform. By prioritizing equity, efficiency, and inclusivity, the White Paper recognized the transformative potential of ICT to bridge the digital divide and empower learners to become active participants in a globalized knowledge economy. However, it also acknowledged the challenges: bridging the urban-rural digital gap, providing ongoing educator training and support, and ensuring the development of relevant and high-quality digital content. Despite these hurdles, the White Paper remains a crucial blueprint for harnessing the power of ICT to create a brighter educational future for all South Africans.

2.4.2.2 National ICT in education policy (2004)

South Africa's National ICT in Education Policy Framework, established in 2004, serves as a roadmap for integrating technology into the entire education ecosystem by operationalizing the White Paper. It aims to achieve an "inclusive, equitable, and efficient" system by outlining strategies five key pillars: infrastructure development, spanning reliable connectivity and hardware access; educator training, ensuring educators are equipped to handle technological tools; curriculum and content development, fostering the creation of digital resources aligned with learning objectives; assessment and monitoring, establishing mechanisms to track progress and refine strategies; and research and development, driving continuous innovation and adapting to technological advancements. This framework acknowledges the digital divide and emphasizes closing the gap in resource distribution while promoting innovative pedagogies and personalized learning experiences. However, realizing its full potential requires addressing ongoing challenges like funding sustainability, educator motivation, and the creation of high-quality digital content. Ultimately, the National ICT in Education Policy Framework seeks to leverage technology's transformative power to prepare South African youth for a knowledge-based society and equip them with the skills they need to thrive in the digital age.

2.4.2.3 Strategy for information and communication technology in education framework (2014)

Marking a critical juncture in South Africa's tech-driven education quest, the 2014 "Strategy for Information and Communication Technology in Education" framework (DoBE, 2014) stands as a comprehensive roadmap for integrating ICT into the national curriculum. Spearheaded by the Department of Basic Education, this ambitious strategy transcends mere infrastructure provision, aiming to unlock the transformative potential of technology in fostering an inclusive, equitable, and efficient education system (DoBE, 2014).

Five pillars anchor this vision: bridging the digital divide by expanding access to reliable ICT infrastructure across all geographic regions (DoBE, 2014); seamlessly weaving technology into the curriculum, ensuring its alignment with learning objectives and pedagogies (DoBE, 2014); empowering educators through robust professional development initiatives, equipping them with the skills and confidence to harness ICT effectively (DoBE, 2014); fostering a culture of research and innovation in the field of ICT in education, promoting continuous exploration of new tools and methodologies (DoBE, 2014); and engaging parents, communities, and stakeholders in collaborative efforts to maximize the impact of ICT integration (DoBE, 2014).

By confronting head-on disparities in infrastructure, nurturing digital literacy across the learner population, and encouraging educators to embrace innovative practices, the 2014 strategy strives

to reshape the educational landscape. Its success hinges on addressing persistent challenges like uneven resource distribution, bridging the digital skills gap, and ensuring the development of high-quality, culturally relevant digital content. Despite these hurdles, the 2014 "Strategy for Information and Communication Technology in Education" remains a vital blueprint, guiding South Africa's ongoing journey towards harnessing technology's transformative power to prepare future generations for success in the digital age.

2.4.2.4 Enhancing ICT readiness of schools in South Africa (2021)

This framework was developed by the Department of Science and Innovation (DSI, 2021) in collaboration with the Department of Basic Education (DBE, 2021). It aimed to bridge the digital divide within South African education by enabling all schools to become more proficient in utilizing ICT for teaching and learning assess and improve the readiness of South African schools to effectively integrate ICT into their teaching and learning practices, thus aligning with the broader national agenda of transforming the education system into one that is efficient, equitable, and prepares learners for the digital age.

The framework incorporates a pioneering five-level strategy known as the "e-Ready Tool," designed to facilitate schools in assessing their ICT readiness comprehensively. This tool offers a systematic self-assessment mechanism, considering crucial factors such as infrastructure, staff capabilities, and pedagogical practices. Each level within the eReady Tool delineates specific requirements and benchmarks, serving as a roadmap for schools to progress toward higher stages of ICT integration. By providing clear criteria, this framework empowers schools to identify their current strengths and weaknesses in ICT implementation. Additionally, it facilitates strategic planning for targeted improvements, offering a structured approach to enhance overall ICT readiness within the educational setting.

The framework underscores key focus areas aimed at advancing ICT integration in education. In terms of infrastructure, it prioritizes the provision of reliable internet connectivity, ensuring schools have access to sufficient technological resources encompassing both hardware and software, and facilitating adequate technical support. Regarding staff development, the framework underscores the necessity for comprehensive educator training, encompassing effective ICT utilization in classrooms. This training includes aspects such as developing digital content, adopting innovative pedagogical approaches, and acquiring technical skills. The policy also advocates for the creation of high-quality digital content aligned with the curriculum and encourages innovative teaching methods that leverage ICT. Lastly, the framework highlights the significance of a robust assessment and monitoring system, emphasizing the need for regular

evaluations to gauge the effectiveness of ICT integration in schools, fostering a culture of continuous improvement within the educational landscape.

2.4.3 Gap between policy and implementation

Numerous ICT in education policies/ frameworks worldwide advocate for these features, emphasizing equity and redress for historically disadvantaged groups (ICT in education policy: South Africa, 2004; ICT in Education policies: Namibia, Uruguay, Jordan, Singapore, Rwanda in Kozma et al, 2011; Singapore, 2008, Ghana, 2015; Rwanda, 2016; Rubagiza et al, 2011; Mozambique ICT in education policy in Muianga, 2013; Chile, Blignaut et al., 2010). While the South African government's efforts to improve the education system through ICT integration are commendable, the ICT policy has not effectively translated into practice, leaving a significant gap between policy and implementation (Saal & Hannan, 2024). This disconnects between policy and practice highlights the need for more comprehensive implementation strategies that address the identified features and ensure the successful integration of ICTs in South African schools. Despite various initiatives aimed at fostering successful ICT integration in South African schools, their impact has been limited by persistent challenges (Saal & Hannan, 2024; Vandeyar, 2013). Recurrent strategies often address similar components without sufficiently considering the diverse contextual realities of individual schools. Notably, the White Paper on e-Education (2004) stands as the primary education policy document guiding ICT integration, while subsequent strategies implemented by separate departments remain fragmented and poorly communicated. This lack of clear articulation and collaborative workshops has resulted in widespread unawareness among school stakeholders, further hindering effective implementation (Padayachee, 2017).

The South African White Paper on e-Education (DoE, 2004) is conspicuously deficient in providing intricate guidelines pertaining to the implementation of its outlined policy objectives. A synthesis of scholarly works underscores the pervasive sentiment that the policy lacks clarity and specificity (Saal & Hannan, 2024; Moosa et al., 2023; Vandeyar, 2013; Padayachee, 2017; du Plesis & Webb, 2012; Cross, 2007; Czerniewicz et al., 2006; Ndlovu, 2016; Vandeyar, 2013). Noteworthy deficiencies include a lack of clarity in objectives, insufficient infrastructural and policy support, a dearth of information concerning skills development, and an undue emphasis on technical features. This focus on technical aspects is at the expense of addressing the principal raison d'être for formulating the ICT policy in education, namely the pedagogical and theoretical frameworks. The absence of explicit guidelines and a nuanced emphasis on pivotal aspects such as pedagogy and theoretical underpinnings collectively diminish the efficacy of the White Paper on e-Education, hindering its practical implementation within the educational landscape.

2.4.4 Policy interpretations and implementation discrepancies

The lack of detailed information within the policy framework leads to divergent interpretations and, consequently, variations in its implementation across schools (Abedi, 2023; Czerniewicz et al., 2006). A comprehensive study conducted by Ndlovu (2016) identifies a notable factor contributing to the sluggish progress in ICT utilization in classrooms—namely, disparities in the understanding of policies. The absence of explicit guiding principles and clarity within the ICT policy has given rise to diverse approaches and applications, fostering nonconformity in the implementation of ICT pedagogical integration, as stipulated in the ICT in education policy (Chisango & Marongwe, , 2021). Despite a marginal increase in computer usage observed in many South African schools for administrative purposes (Nkambule & Ngubane, 2024; Law, Pelgrum & Plomp, 2008), the actual integration of ICTs into teaching and learning remains a formidable challenge (EdTech Hub, 2020; GOLA, 2020; World Covid group, 2020; Blignaut, 2010; SITES, 2006).

Policy interpretation and implementation are two crucial phases of the policymaking process, each playing a vital role in ensuring the successful translation of policy intent into tangible outcomes (Abedi, 2023; Hill & Hupe, 2014). Policy interpretation involves deciphering the meaning and intent of a policy document, while policy implementation entails putting the policy into action. Both processes are complex and intricate, requiring careful consideration of various factors to achieve desired policy outcomes.

Effective policy interpretation necessitates a range of skills, including legal analysis, policy analysis, contextual analysis, and communication skills (Mukherjee, Coban & Bali, 2021; Dunn & Marland, 2005). Legal analysis involves understanding the legal framework surrounding the policy and identifying relevant legal concepts (Chan, 2023; Rosenbaum, 2011). Policy analysis involves comprehending the policy's objectives, targets, expected outcomes, and underlying assumptions (Birkland, 2019; Hill & Hupe, 2014). Contextual analysis involves understanding the social, economic, and political context in which the policy was developed and is being implemented (Enserink et al., 2022; Weiss, 1999). Communication skills are essential for conveying the policy's interpretation to policymakers, practitioners, and the public (Leggett, 2022; Dunn & Marland, 2005).

Effective policy implementation requires a combination of clear policy goals and objectives, adequate resources, effective communication and coordination, and ongoing monitoring and evaluation (Chan, 2023; Enserink et al., 2022; Palumbo & Sabatier, 1988; Bardach, 2000). Clear policy goals and objectives provide direction, allowing for measuring progress and assessing effectiveness. Adequate resources ensure that the policy has the necessary personnel, funding, and

equipment for implementation. Effective communication and coordination facilitate collaboration among stakeholders involved in implementing the policy. Monitoring and evaluation assess the policy's effectiveness and inform necessary adjustments, ensuring that the policy remains relevant and adaptable to changing needs (Chan, 2023; Dunn, 2001).

Despite their importance, policy interpretation and implementation face several challenges. Ambiguity in policy language can lead to misinterpretation and misapplication, hindering effective implementation (Moosa et al., 2023; Naidoo et al., 2024; Rosenbaum, 2011). Resource constraints can hinder effective implementation, as insufficient funding or personnel can limit the policy's reach and impact (Kgosi, Makgato & Skosana, 2023; Palumbo & Sabatier, 1988). Lack of political will impede enforcement and resource allocation, as policymakers may prioritize other agendas or face political opposition (Birkland, 2019; Hill & Hupe, 2014). Resistance from stakeholders can obstruct implementation, particularly when it disrupts established practices or conflicts with vested interests (Chan, 2023).

Overcoming these challenges requires a comprehensive approach that addresses the root causes of the issues. Clear and concise policy language, thorough planning, and resource allocation, building consensus among stakeholders, and continuous evaluation and adaptation are crucial for successful policy interpretation and implementation. By proactively addressing these challenges, policymakers can increase the likelihood that their policies achieve their intended outcomes and make a positive impact on society.

2.5 ICT Implementation of schools in the developed countries

A comparative analysis of ICT implementation in developed countries provides a robust foundation for formulating a conceptual framework that guides the effective integration of technology into the South African educational context. The ICT revolution has profoundly impacted education across the globe, particularly in developed nations. Schools in these countries have embraced advanced technological infrastructure, aiming to leverage its potential for enhanced learning, engagement, and educational equity. This section delves into the landscape of ICT implementation in schools of the developed world, exploring its opportunities, challenges, and insights for future advancement.

The landscape of ICT integration in education in developed countries presents a fascinating interplay between national strategies and school-level practices. While national-level policies set the overarching vision and provide resources, the nuances of implementation often play out within the dynamic walls of individual schools. This section explores the intricate dance between these two levels, highlighting both their potential synergies and potential pitfalls.

National-level ICT policies serve as the foundational framework upon which effective school-based integration of ICTs can be systematically constructed. These policies are designed to address key areas essential for successful integration, encompassing vision and strategic direction, infrastructure and resource allocation, curriculum, and assessment integration, as well as professional development and support. The focus on vision and strategic direction involves establishing a clear vision for the role of ICTs in education, delineating desired outcomes, and aligning with overarching national educational goals (UNESCO, 2022). Furthermore, investment in robust and equitable access to technology is crucial, encompassing hardware, software, and reliable internet connectivity to ensure that all schools can leverage ICT resources effectively (OECD, 2015). The integration of ICTs into the curriculum framework is a central aspect, requiring policies to provide guidelines for their effective use in teaching and learning. Additionally, there is a need for the development of new assessment strategies that incorporate technology use, aligning with the principles outlined by the International Society for Technology in Education (ISTE, 2019). Finally, national policies must address the imperative of professional development and support for educators, ensuring they are equipped with the necessary pedagogical skills and technological knowledge to integrate ICTs confidently and effectively into their classrooms (Voogt, 2013). This comprehensive approach underscores the integral role of national policies in providing a structured and supportive environment for the seamless integration of ICTs in schools, fostering a conducive landscape for effective teaching and learning in the digital age.

Strong national policies lay the foundation for success by creating a supportive environment, allocating resources, and providing direction for schools. However, the devil is often in the implementation details. While national policies serve as the overarching framework, the intricate process of ICT integration unfolds within the distinctive contexts of individual schools, leading to crucial considerations for effective implementation. Central to this is the role of leadership and school culture, where strong leadership becomes paramount in championing ICT integration, fostering a culture of innovation, and allocating resources to support educators (Kwatubana, 2023; Levin, B., & Fullan, M, 2008). This leadership dynamic serves as a bridge between national policies and local implementation. Equally critical is the focus on educator knowledge and confidence, emphasizing the necessity for educators to possess a pedagogical understanding of how technology can enhance, rather than replace, learning experiences (ISTE, 2019). Tailored professional development programs, adapted to the unique needs of each school, play a pivotal role in building educator confidence and competence. Acknowledging the diverse landscape of schools in terms of resources, infrastructure, and learner demographics, the adaptability of national policies becomes crucial. Contextual factors necessitate tailored adaptations, ensuring alignment with the specific needs and challenges faced by each school (Baako & Abroampa, 2024; Voogt,

2013). Finally, the importance of continuous monitoring and evaluation at the school level cannot be overstated. Regular assessment of the impact of ICT integration enables the identification of areas of strength and weakness, informs future strategies, and ensures sustained alignment with national educational goals (UNESCO, 2022). This comprehensive approach recognizes the intricate interplay between national policies and localized realities, emphasizing the need for adaptive leadership, educator empowerment, contextual adaptability, and continuous improvement to drive successful ICT integration in schools. Therefore, effective ICT integration requires a delicate balance between the broad directives of national policies and the nuanced realities of individual schools.

The success of ICT integration in developed countries is contingent upon effectively bridging the gaps between national and school-level initiatives. Central to this success are key strategies that harmonize national guidance with localized adaptability. Emphasizing decentralized implementation supported by national policies, it is essential to grant schools flexibility to experiment within their specific contexts, thereby empowering them to tailor solutions to their unique needs while ensuring alignment with overarching national goals (OECD, 2015). Additionally, fostering collaborative networks is imperative. Establishing robust connections among schools, policymakers, researchers, and technology providers through communities of practice facilitates knowledge sharing, the dissemination of best practices, and a supportive environment for schools encountering challenges (UNESCO, 2019). Moreover, a data-driven approach is essential for informed decision-making. Regularly collecting and analyzing data on ICT use and its impact at both national and school levels can inform policy adjustments, resource allocation, and the design of effective professional development programs (Ng, 2023; Voogt, 2013). These strategies collectively contribute to a comprehensive framework that aligns national vision with localized adaptability, ensuring that ICT integration is not only guided by overarching policies but is also responsive to the dynamic needs and challenges encountered at the school level.

The integration of ICT in developed countries heralds a multitude of opportunities for the transformative evolution of education. Among these, personalized learning emerges as a key advantage, facilitated by adaptive learning platforms and intelligent tutoring systems that customize instruction based on individual learner needs and learning styles, ensuring optimal learning trajectories (Holmes, Anastopoulou, Schaumburg, & Mavrikis, 2018). Moreover, interactive digital tools, virtual reality simulations, and online collaborative platforms play a pivotal role in enhancing engagement and fostering active learning environments (OECD, 2018). This not only promotes collaboration beyond geographical boundaries but also cultivates communication, critical thinking, and problem-solving skills among learners (Laferrière, 2018).

ICT contributes significantly to the development of essential 21st-century skills, including digital literacy and media literacy, enabling learners to become responsible digital citizens well-equipped for a globalized world (ISTE, 2019). Furthermore, technology serves as a powerful tool for promoting equity and access in education, bridging the digital divide by providing inclusive access to educational resources for learners from diverse backgrounds and geographical locations (UNESCO, 2017). Online platforms and digital content not only address socio-economic barriers but also cater to learners with disabilities, offering flexible learning opportunities that contribute to a more accessible and inclusive educational landscape (Dlamini & Dewa, 2021; Holmes, Anastopoulou, Schaumburg & Mavrikis, 2018)

Despite the promising prospects that ICT offers, its implementation in developed countries encounters a set of formidable challenges. The persistence of a digital divide remains a significant hurdle, with unequal access to technology and reliable internet connectivity contributing to disparities in learning opportunities and outcomes (OECD, 2015). To address this, crucial steps involve tackling infrastructure limitations and affordability issues, ensuring that all learners have equitable access to educational resources (UNESCO, 2019). Another critical challenge lies in the need for educators to possess not only technological literacy but also pedagogical knowledge on effectively utilizing technology for learning (Lomos, 2023; Voogt, 2013). Robust professional development programs are deemed essential to equip educators with the requisite skills and confidence for successful ICT integration (UNESCO, 2016). Additionally, the pressing concern of balancing the benefits of educational technology with learner data privacy and security necessitates the implementation of robust data governance frameworks and comprehensive education on responsible online behavior (ISTE, 2019). The financial aspect poses its own challenge, as maintaining and upgrading technology infrastructure incurs costs for schools (Ajani, 2023; Voogt, 2013). Addressing this challenge requires sustainable funding models and effective resource allocation, and public-private partnerships alongside innovative technology solutions are identified as pivotal in ensuring continued progress in ICT implementation in the educational landscape.

The successful implementation of ICT in developed countries is contingent upon several critical insights. First and foremost is the imperative to focus on pedagogy rather than the technology itself; technology should be viewed as a tool to enhance existing pedagogical practices rather than a replacement. This underscores the importance of developing effective teaching strategies that capitalize on the opportunities offered by ICT, as emphasized by the International Society for Technology in Education (ISTE, 2019). Collaboration emerges as a cornerstone for success, necessitating the active engagement of educators, researchers, policymakers, and technology providers. By fostering collaboration and knowledge sharing, particularly through the

establishment of communities of practice, continuous improvement and the exchange of best practices become achievable goals (OECD, 2015). Moreover, recognizing the diversity of schools and communities, a contextualized approach to ICT implementation is deemed essential. Acknowledging the unique needs and contexts of individual educational settings, as opposed to adopting one-size-fits-all approaches, is crucial for success (Braun & Clark, 2021; Voogt, 2013). Lastly, the commitment to continuous evaluation and research is paramount. Rigorous and ongoing assessment of ICT programs is vital for gauging their impact on learning outcomes, identifying challenges, and informing future strategies. Emphasizing the need for context-specific research to guide evidence-based decision-making, UNESCO (2016) stresses the importance of research focusing on specific educational contexts and challenges. Collectively, these insights form a strategic framework for the effective and sustainable integration of ICT in developed countries' educational landscapes.

Effective ICT integration in developed countries demands a shift towards synergistic collaboration across national and school-level initiatives. Fostering strong partnerships and communication channels can leverage the combined strengths of centralized policy frameworks and localized implementation strategies, as advocated by (Shamir-Inbal & Blau, 2021; Conrads et al., 2017). This collaborative approach paves the way for a future where technology is not merely deployed, but truly empowers learners by fostering critical thinking, problem-solving, and digital citizenship skills (Eshet-Alkalai et al., 2018)

However, recognizing the challenges remains crucial. Developed countries must continue to address issues such as equitable access, educator professional development, and data privacy concerns, as highlighted by Raja (2024) & Warschauer (2004). Data-driven decision-making, informed by ongoing research and evaluation, offers a powerful tool for navigating these complexities, as emphasized by UNESCO (2023). By systematically analysing program outcomes and adapting strategies based on evidence, developed nations can ensure their ICT investments translate into meaningful **learner empowerment** and enhanced preparation for the demands of the 21st century, equipping them with the necessary skills to succeed in an increasingly technology-driven world as disclosed in the 2020 World Economic Forum (Whiting, 2020).

2.6 ICT Implementation in schools in the developing countries

This section focuses on ICT implementation in developing countries. By understanding the intricacies and challenges faced in these contexts, the researcher aims to identify effective strategies, streamline processes, and inspire similar initiatives in other developing regions. Ultimately, this research contributes to a more comprehensive and effective conceptual framework for the integration of ICT into pedagogy.

The deployment of ICT in schools within the developing world is a dynamic yet challenging endeavor, marked by a range of perspectives and obstacles. Recent research provides insights into the current landscape, shedding light on key considerations and hurdles. Despite the potential benefits of ICT, challenges persist, reflecting the unique socio-economic contexts of developing countries. The "digital divide" remains a significant issue, indicating unequal access to technology and the internet (OECD, 2021). Addressing this disparity is crucial for ensuring that all learners have an equitable opportunity to harness the educational advantages offered by ICT.

The landscape of ICT integration in education within developing countries presents a dynamic interplay between grand national aspirations and the intricate realities at the school level. At the national level, ambitious frameworks serve as the cornerstone for ushering in a transformative era in education through ICT. These policies demonstrate a concerted effort to prioritize key elements essential for effective ICT-driven educational advancement. A paramount focus is on vision and equity, encapsulating a clear mission to leverage technology for fostering educational equity and enhancing learning outcomes, particularly among marginalized communities (UNESCO, 2022). Exemplifying this commitment, India's National Education Policy (NEP) 2020 champions personalized and inclusive education through the seamless integration of ICT (Ministry of Education, Government of India, 2020). Addressing the persistent digital divide emerges as another critical aspect of national policies. Robust frameworks tackle this challenge by directing investments towards ensuring reliable internet connectivity, even in remote areas, thus striving for equitable access to technology across all schools (ITU, 2020). Moreover, national frameworks exhibit a commitment to curriculum and pedagogy, seamlessly integrating ICTs into existing educational structures. These frameworks not only develop guidelines for the effective utilization of ICT in teaching and learning but also remain attentive to local contexts and needs (ISTE, 2019). Recognizing the pivotal role of educators in this transformative journey, national strategies place a strong emphasis on empowering educators. Comprehensive professional development programs are prioritized, aiming to equip educators with both pedagogical skills and technological expertise, thereby fostering their confidence and competence in navigating the complexities of ICT integration (Ng, 2023; Kilag et al., 2023; Voogt, 2013). This holistic approach at the national level underscores a commitment to providing the necessary foundations for successful ICT implementation, reflecting a vision that encompasses educational equity, digital inclusion, pedagogical innovation, and educator empowerment.

These national efforts lay the foundation for a supportive environment and provide a roadmap for effective ICT integration. However, translating these aspirations into tangible benefits for learners at the school level requires navigating intricate challenges. At the grassroots level, schools contend with pragmatic challenges frequently overshadowed by national policy frameworks.

These challenges underscore the intricate realities of ICT integration in educational settings and encompass a spectrum of issues. Foremost among these challenges are resource limitations, where budgetary constraints, inadequate infrastructure, and restricted access to hardware and software pose significant barriers to the seamless integration of ICT (Warschauer, 2016). The competence and confidence of educators emerge as another critical hurdle; many educators may lack the requisite pedagogical skills and technological proficiency to confidently incorporate ICT into their teaching methodologies. Addressing this challenge necessitates tailored professional development programs designed to meet the specific needs of educators (Ng, 2023; Voogt, 2013).

Contextual adaptability is a paramount concern, particularly as national policies often struggle to effectively address the diverse needs of schools situated in rural areas, urban slums, or conflict zones. To overcome this, adaptable approaches that can be contextualized to the unique settings and challenges of local communities become indispensable (UNESCO, 2016). Additionally, the sustainability and maintenance of ICT initiatives present a considerable challenge. Ensuring the long-term success of these initiatives requires a comprehensive strategy that includes proper equipment maintenance and ongoing professional development for educators. This approach guards against the risk of ICT projects faltering after initial investments, emphasizing the need for sustained commitment and support (ITU, 2020). In sum, the challenges faced by schools at the grassroots level underscore the imperative of acknowledging and addressing the nuanced realities of ICT integration, ensuring that national policies are not only aspirational but also pragmatic and responsive to the diverse contexts of individual educational institutions.

The challenges delineated emphasize the imperative for a comprehensive approach that acknowledges the intricate relationship between national ICT aspirations and the diverse realities of individual schools within developing countries' education systems. Several pivotal strategies can be adopted to bridge gaps, facilitate effective integration, and unleash the transformative potential of ICTs. Recognizing the inherent limitations of rigid, top-down approaches in addressing the varied needs of diverse school contexts, implementation of ICT integration should be decentralized with national support. A decentralized model at the national level is envisioned, which is characterized by the provision of broad guidelines and standards. Crucially, this approach grants schools the flexibility to adapt and experiment within their unique settings, fostering localized ownership and the development of tailored solutions. In essence, national frameworks would serve as guiding principles, enabling schools to leverage the wisdom and expertise of their communities to develop solutions that are most relevant and effective for their learners and educators (OECD, 2015). Acknowledging the inherent constraints of individual initiatives, the cultivation of robust networks and communities of practice emerges as a vital strategy to enhance capacity and foster collaboration in the pursuit of successful ICT integration.

Successful ICT integration in developing countries demands a multifaceted approach that transcends individual actors and fosters collaborative networks. Establishing communities of practice, comprised of schools, policymakers, researchers, and technology providers, serves as a potent facilitator for knowledge sharing, mutual support, and the co-creation of context-specific solutions (UNESCO, 2019). Such networks empower schools facing challenges to leverage the collective expertise of the community, while researchers and policymakers gain invaluable insights from frontline educators. However, generic educator training programs often prove inadequate, failing to equip educators with the necessary skills and knowledge for effective ICT integration within their specific contexts (Kilag et al., 2023; Voogt, 2013). A paradigm shift towards context-sensitive professional development is therefore imperative. These programs, tailored to the individual needs and challenges of each school and educator, ensure relevance and efficacy within their local environment. This focus on local needs directly addresses a critical challenge for developing countries seeking sustainable ICT integration (Warschauer, 2016). Furthermore, the success of ICT implementation hinges on the capacity and readiness of educators. Limited training and professional development opportunities in developing countries often translate into challenges for educators effectively integrating technology into their practices (UNESCO, 2022). A nuanced and contextualized approach, therefore, becomes crucial. Tailoring strategies to the specific needs and challenges of individual schools and communities is paramount for success. Finally, continuous evaluation and research are indispensable components for navigating the complexities of ICT implementation in developing contexts. Ongoing assessment helps gauge the impact of ICT initiatives on learning outcomes, identify challenges, and inform adaptive strategies. Additionally, research focusing on the unique contexts and challenges of developing countries provides valuable insights for evidence-based decision-making (UNESCO, 2022). By fostering collaborative networks, prioritizing context-sensitive professional development, and embracing continuous evaluation and research, developing countries can chart a more effective course towards successful and sustainable ICT integration in education.

Short-sighted and poorly planned ICT initiatives often falter due to insufficient resources and a lack of long-term planning. The implementation of ICT in developing countries is also intricately linked to issues of infrastructure, affordability, and digital literacy. Limited infrastructure, including inadequate internet connectivity and hardware, poses obstacles to widespread adoption (UNESCO, 2022). Affordability remains a critical concern, requiring strategic financial models to ensure sustainable ICT integration in resource-constrained environments (Warschauer & Matuchniak, 2010). To foster sustainable integration, developing countries must prioritize the development of sustainable solutions that consider the long-term costs of maintenance, educator training, and infrastructure support. This proactive approach ensures that technology initiatives become ingrained within the educational landscape, empowering learners, and transforming

classrooms beyond fleeting pilot projects (ITU, 2020). Embracing these interconnected strategies allows developing countries to transcend the existing gap between national aspirations and school realities. By building bridges through decentralized implementation, collaborative networks, context-sensitive training, and sustainable investments, these nations can pave the way for a future where ICTs play a central role in empowering learners and transforming educational landscapes across diverse contexts.

ICT implementation in schools in the developing countries presents a complex and multifaceted landscape. Addressing issues of access, infrastructure, affordability, educator readiness, and context-specific challenges is essential for unlocking the transformative potential of ICT in education. As the field evolves, ongoing research and adaptive strategies will play a pivotal role in shaping effective and sustainable ICT integration in the educational systems of developing countries.

2.7 Successful ICT implementation

The burgeoning role of ICTs in education transcends geographical boundaries, with developed nations pioneering innovative approaches to leveraging its potential. Two countries, Finland, and Singapore, stand as beacons of success, each embodying distinct yet fruitful pathways to ICT integration in schools.

Finland's educational prowess goes together with its nuanced approach to ICT integration. Rather than prioritizing technology itself, Finnish educators are empowered to seamlessly weave it into existing pedagogies, prioritizing learner agency and collaborative learning (Korhonen et al., 2023; Voogt, Fisser, Roblin, Tondeur & van Braak, 2013).

This comprehensive approach to ICT integration in education relies on a multifaceted strategy. Central to its success is a focus on cultivating educator expertise through robust professional development programs, ensuring educators possess the necessary pedagogical knowledge and technological skills to confidently integrate ICTs into their classrooms (UNESCO, 2022). Emphasizing educator autonomy and expertise, this approach encourages creative exploration and context-specific integration. Moreover, a collaborative knowledge creation model is employed, particularly evident in the practices of Finnish educators who prioritize sharing experiences and best practices, thereby establishing a robust network of professional learning communities. This collaborative ethos contributes to continuous improvement and ensures the grassroots dissemination of knowledge (Dahal, Luitel, Pant, Shrestha, & Manandhar, 2020). Importantly, the approach underscores the principle that technology should enhance existing pedagogies rather than replace them. Prioritizing pedagogical soundness over novelty, the focus remains on fostering deep learning and critical thinking skills through well-designed learning experiences. Here, ICT

acts as a catalyst for collaboration, inquiry, and problem-solving, reinforcing the idea that technology should serve as a tool to augment and enrich the learning process (Kokkinos, 2024; Voogt, 2013). This holistic strategy encapsulates a dynamic and synergistic approach, acknowledging the pivotal role of educators, collaborative learning communities, and the judicious use of technology in achieving meaningful educational outcomes.

Finland's success lies in its unwavering commitment to empowering educators, prioritizing pedagogical soundness, and nurturing a collaborative culture. This approach ensures that technology aligns seamlessly with existing educational priorities, maximizing its impact on learner learning.

While the pedagogical integration of ICTs in schools remains a challenge for many countries, there are notable success stories that offer valuable insights for improving ICT implementation practices. Singapore, for instance, has made significant strides in this regard through its three-phase ICT master plans, characterized by a progressive five-year approach that emphasizes continuous monitoring, evaluation, and refinement (Soo et al., 2023; Kilag et al, 2023; Lim, 2007; Kozma, 2005; Kozma et al., 2011). The landscape of ICT integration in education is marked by diverse approaches, each bearing unique strengths and potential pitfalls. This iterative approach has allowed Singapore to continuously enhance its education system by making ongoing adjustments to its ICT policy, ensuring its relevance and responsiveness to the evolving needs of the country (Kozma et al., 2011, p. 38).
Among these strategies, Singapore's "Masterplan for ICT in Education" stands out as a model of comprehensive and forward-thinking integration, characterized by three key pillars:

1. Building the backbone: comprehensive infrastructure rollout
Singapore recognizes the crucial role of robust infrastructure in enabling equitable access and seamless technology utilization. Schools boast high-speed internet, interactive whiteboards, digital content repositories, and a diverse array of digital devices, ensuring no learner is left behind in the digital age (UNESCO, 2022). This investment fosters an environment where technology is readily available and readily adaptable to diverse learning needs.
2. Personalized learning journeys: Tailoring instruction and igniting engagement
Beyond hardware, Singapore's plan embraces the power of personalized learning. Adaptive learning platforms cater to individual learner needs and learning styles, dynamically adjusting instructional content and pace to optimize growth. Additionally, immersive virtual reality experiences spark excitement and engagement, transforming abstract concepts into interactive journeys (Cowin, 2020). These pedagogical strategies leverage technology as a tool to enhance learning, not replace it, catering to individual strengths and fostering deeper understanding.

3. Curriculum innovation: Weaving technology into the fabric of learning

The Masterplan doesn't merely equip schools with technology; it actively integrates it into the curriculum. Digital literacy skills and higher-order thinking are nurtured through technology-infused learning activities and projects across various disciplines. Ongoing curriculum development ensures continued relevance, reflecting the evolving nature of technology and its integration into real-world contexts (ISTE, 2019). This dynamic approach equips learners with not only technological proficiency but also the critical thinking skills needed to navigate the digital landscape with confidence.

Singapore's success cannot be attributed to single-minded application; rather, it lies in its willingness to learn and adapt. The Masterplan undergoes continuous evaluation and refinement, ensuring its strategies remain relevant and responsive to emerging needs. This spirit of innovation and adaptability serves as a valuable lesson for other nations. By understanding the strengths and nuances of Singapore's approach, other countries can tailor their own strategies to achieve effective ICT integration. While infrastructure, personalized learning, and curriculum innovation are essential pillars, the specific needs and contexts of each nation must be considered. Embracing the multifaceted nature of ICT integration and acknowledging the lessons offered by diverse models are crucial steps in paving the way for a future where technology empowers learners and revolutionizes educational landscapes across the globe.

While dominant narratives surrounding ICT integration in developing countries often focus on challenges, Emerging success stories are challenging entrenched narratives surrounding the limitations of ICT integration in developing countries. Countries like Rwanda, Vietnam, Jordan, and Hungary have emerged as beacons of hope, illustrating how resourcefulness, strategic planning, and innovative approaches can pave the way for effective ICT utilization in education. These countries stand apart by demonstrating that transformative change is possible even in resource-constrained environments, offering valuable insights and inspiration for others embarking on similar journeys.

Rwanda launched a project in 2006 known as One Laptop per Child (OLPC) initiative which stood as a remarkable leapfrogging strategy in the realm of ICT integration. This innovative approach involved equipping learners with rugged, low-cost laptops embedded with educational software, transcending barriers in remote areas with limited infrastructure (Warschauer, 2016). The impact of this initiative had been multifaceted, yielding substantial improvements in learning outcomes, particularly in mathematics and English language skills, as evidenced by studies (Adegoke, Akinrinola & Ogegbo, 2023). The provision of access to interactive digital resources and learning activities had not only augmented engagement but had also cultivated a culture of

independent learning. Beyond academic achievements, the OLPC program had been instrumental in democratizing access to technology, thereby diminishing digital disparities and empowering learners from marginalized communities (Alam, 2023; Voogt, 2013). This newfound autonomy and connectivity had opened doors to opportunities extending beyond the confines of traditional classrooms. Moreover, the initiative had been pivotal in fostering 21st-century skills among learners. Through technology use, learners acquired valuable digital literacy skills and honed critical thinking abilities. Collaborative online learning platforms, integral to the OLPC program, served as conduits for enhancing communication and problem-solving skills, strategically preparing learners for success in a technology-driven world (UNESCO, 2019). In the chronicles of ICT integration, Rwanda's OLPC initiative emerges as a paradigm of success, illustrating the transformative potential of strategic ICT interventions in education. While challenges remain, such as ensuring sustainable internet access and educator training, Rwanda's OLPC initiative demonstrates the transformative potential of ICTs in overcoming resource constraints and fostering educational equity in developing contexts.

Vietnam's approach to ICT integration in education distinguishes itself through its nuanced understanding of the interplay between technology and cultural context. Unlike models that risk homogenization, Vietnam prioritizes cultural relevance by translating and adapting curriculum materials to local languages and traditions. This "culturally responsive curriculum development," as lauded by UNESCO (2016), fosters a sense of ownership and engagement within diverse communities of learners and educators. Similarly, Vietnam recognizes the crucial role of empowered educators in harnessing the potential of ICTs. Robust professional development programs, drawing on insights from Moore, Nguyen & Nguyen (2023) and Voogt (2013), equip educators with the necessary knowledge and skills to seamlessly integrate technology into their classrooms, ensuring that technology complements existing practices and enhances learning outcomes. Bridging the digital divide remains a vital concern, and Vietnam tackles it through innovative and sustainable solutions. Initiatives like solar-powered internet connectivity and community technology centers provide equitable access to technology even in remote areas (Warschauer, 2016). By prioritizing cultural responsiveness, educator empowerment, and equitable access, Vietnam offers a compelling model for ICT integration that aligns with local needs and aspirations, demonstrating a path towards a truly sustainable and inclusive educational landscape.

Similarly, Jordan has demonstrated success in ICT integration by focusing on key initiatives that facilitate effective implementation. Some of these initiatives include access to meaningful, high-quality, and culturally relevant content: Ensuring that ICT-based learning resources are aligned with the curriculum and cultural context of Jordanian learners is crucial for their engagement and

understanding. (Alkhawaldeh & Khasawneh, 2023; Kozma, 2005). The schools in Jordan also engage in broad-based community support whereby fostering a supportive environment that encourages collaboration among educators, parents, and community members is essential for creating a shared vision and commitment to ICT integration. (AlAli & Wardat, 2024; Kozma et al., 2011). They also tend to align professional development with curriculum goals. According to (Voogt et al., 2008), Professional development programs for educators are directly linked to the curriculum goals and provide practical strategies for integrating ICTs into teaching and learning. Furthermore, active community involvement takes place which encourages engaging the community in ICT initiatives that can provide valuable resources, expertise, and support for successful implementation. (Turcsányi-Szabó, 2008, in Voogt et al., 2008).

Hungary, another emerging developing country, has also made notable advancements in ICT integration in schools. One of the key factors contributing to Hungary's success is the compulsory teaching of informatics across all levels of education, ensuring that learners develop essential digital literacy skills from an early age (Monnet, 2022; Turcsányi-Szabó, 2008, in Voogt et al., 2008). Additionally, the Hungarian government has played a significant role by providing nationwide internet access.

The nascent successes of Rwanda, Jordan, Hungary, and Vietnam in integrating ICTs into their education systems offer invaluable lessons for other developing nations embarking on a similar journey. At the heart of their triumphs lies a fundamental understanding: one-size-fits-all solutions rarely bear fruit. Rigid, imported models often falter, highlighting the critical need for tailoring ICT strategies to each nation's unique needs, resources, and cultural nuances (Voogt, 2013). These countries demonstrate the power of prioritizing people and pedagogy. Technology, in their hands, becomes a tool to empower educators and enhance existing pedagogies, not a replacement for them (ISTE, 2019). Robust educator professional development programs equip educators with the skills and knowledge to seamlessly integrate technology into their classrooms, fostering culturally responsive curriculum development that resonates with diverse learners. Furthermore, these nations illustrate the transformative potential of collaboration and innovation. Sharing best practices, fostering vibrant learning communities, and partnering with stakeholders across sectors pave the way for sustained progress and innovative solutions (UNESCO, 2019). Rwanda's focus on leveraging open-source technologies, Vietnam's community technology centers, Jordan’s broad -based community support and Hungary’s compulsory informatic courses ensuring digital literacy takes place from an early age, stand as testaments to the power of collective ingenuity.

Effectively integrating ICTs into the education systems of developing countries requires a multifaceted approach informed by key strategies and contextual awareness. Recognizing the

importance of context-specific implementation, Cabellos, Siddiq & Scherer (2024); Lim (2007) and Kozma (2005) emphasize tailoring ICT use to individual countries' needs, considering factors like curriculum, culture, and infrastructure. Collaboration among stakeholders, including educators, parents, communities, and government agencies, fosters a supportive and inclusive environment, as highlighted by Alkhawaldeh & Khasawneh (2023); Lim (2007) and Kozma et al. (2011). Continuous professional development empowers educators with the necessary skills and knowledge to utilize ICT effectively, as emphasized by Moore, Nguyen & Nguyen (2023) and Kozma (2005). Finally, data-driven decision-making, advocated by Kozma et al. (2011), enables ongoing monitoring and evaluation, leading to the adaptation and improvement of implemented strategies.

Beyond these critical strategies, insights from successful ICT integration initiatives in diverse emerging economies hold invaluable potential. By embracing this global tapestry of experiences and forging their own unique paths, developing nations can cultivate vibrant learning spaces where technology empowers every child, regardless of background or location. This collective vision, adaptable to diverse contexts, serves as a beacon for achieving the shared goal of equitable, technology-driven education for all. For instance, South Africa can glean valuable lessons from these international successes and utilize them to refine its own ICT in education policies. By crafting an actionable implementation framework tailored to its specific context, emphasizing practical and iterative plans with regular review and adaptation, South Africa can overcome challenges and harness the transformative power of technology to improve the quality of education for all its learners. This combined approach, informed by global context, and tailored to local needs, offers a promising pathway towards unlocking the full potential of ICTs for enriching educational experiences across developing nations.

2.8 Enablers and Constraints influencing effective ICT implementation process.

This section is essential as it provides a comprehensive overview of the complex interplay of factors influencing ICT integration in schools, particularly within the context of resource limitations. By delineating the enablers and constraints at various levels, this section contributes directly to the study's objectives by laying a strong foundation for investigating the relationship between resource limitations and pedagogical ICT integration in South African schools.

The realization of policy objectives within the educational landscape is a complex and dynamic process that involves a multitude of factors operating at various levels, from the macro-level formulation of policies by government officials to the micro-level implementation by educators and learners (Chai et al., 2014). This intricate process is not merely a linear translation from

government decree to practical application; rather, it is a nuanced progression shaped by a range of enablers and constraints that influence the ultimate success or failure of policy implementation.

At the macro level, the effectiveness of policy formulation hinges on the clarity, coherence, and alignment of policy goals with the broader educational objectives and needs of the country (Ajulor, 2018). Clearly defined and well-articulated policies provide a strong foundation for successful implementation, while ambiguous or misaligned policies can lead to confusion, misinterpretation, and ultimately, ineffective implementation.

Funding mechanisms play a crucial role in enabling the translation of policy intent into tangible outcomes at the micro level (Mokate, 2023; Maduabum, 2008). Adequate funding ensures that schools have the necessary resources, infrastructure, and personnel to support the implementation of policies. Insufficient funding, on the other hand, can hinder the implementation of even well-conceived policies, as schools may lack the capacity to acquire ICT equipment, provide professional development for educators, or provide adequate support for learners with diverse needs.

Professional development initiatives are essential for equipping educators with the knowledge, skills, and competencies necessary to effectively implement ICT integration policies (Younis, 2006). Ongoing professional development opportunities allow educators to stay abreast of the latest ICT advancements, develop pedagogies that integrate ICTs into their teaching practices, and address any challenges they may encounter during implementation. Without adequate professional development, educators may lack the confidence and expertise to effectively implement ICT integration policies, leading to suboptimal outcomes for learners.

Monitoring and support frameworks are critical for ensuring that policy implementation is on track, identifying potential challenges, and making necessary adjustments (Ed Tech Hub, 2020). Regular monitoring provides valuable insights into the progress of implementation, while ongoing support ensures that schools and educators have the resources and guidance, they need to overcome obstacles and achieve policy goals. Effective monitoring and support frameworks help to bridge the gap between policy intent and practical application, ensuring that policies are implemented in a way that aligns with the intended objectives.

Resource allocation, encompassing both financial and material resources, plays a pivotal role in facilitating or impeding the realization of ICT integration policies (Ajulor, 2018). Adequate allocation of resources ensures that schools have the necessary ICT equipment, software, and connectivity to support effective ICT integration. However, inequitable resource allocation,

particularly between urban and rural schools, can create disparities in ICT access and hinder the implementation of policies aimed at promoting digital equity.

The state of educational infrastructure, including physical facilities, technological resources, and internet connectivity, also significantly influences the feasibility and effectiveness of ICT integration policies (Mokate, 2023; Maduabum, 2008). Schools with outdated or inadequate infrastructure may face challenges in implementing ICT integration initiatives, as they may lack the capacity to support the installation, maintenance, and operation of ICT equipment. Addressing infrastructural challenges is crucial for creating a conducive environment for ICT integration and ensuring that all learners have equitable access to technology-enhanced learning opportunities.

The realization of ICT integration policy objectives in the educational landscape is a complex and multifaceted process that hinges on a range of factors operating at various levels, from macro-level policy formulation to micro-level implementation by educators and learners. Effective policy implementation requires a holistic approach that addresses the enablers and constraints discussed above, ensuring that policies are not only well-conceived but also effectively translated into practice to achieve the desired outcomes for learners.

2.8.1 The role of political will and school leadership in ICT integration

The successful integration of ICTs in education is contingent upon a range of factors, including unwavering political will and effective school leadership. At the macro level, political commitment and support are essential for driving ICT integration efforts (Kwon & Park, 2023; Sharma, 2003). Political leaders play a crucial role in fostering an environment conducive to ICT adoption, and their vision and influence can significantly impact the success of ICT initiatives (Macdonald & Ahiakwo, 2023; Richardson, 2008). As Lomos et al., (2023) and Sharma (2003) asserts, strong political will can manifest in various forms, such as allocating adequate funding for ICT infrastructure and professional development, establishing clear ICT policies and goals, and providing ongoing support and monitoring of ICT integration efforts.

At the micro level, school leadership emerges as a critical determinant of ICT integration success (Mthanti & Msiza, 2023; Vandeyar, 2013). Effective school leaders act as catalysts for innovation, promoting the integration of ICTs into classroom practices (Sweeney, 2005). In the context of ICT integration, effective school leaders exhibit three key qualities. Firstly, a clear vision, as emphasized by Ertmer (1999), serves as a guiding force for ICT integration efforts. When the school leader champions a well-articulated ICT vision, it has the power to unite the school community toward a shared goal of enhancing teaching and learning through technology. Secondly, effective ICT implementation necessitates strong managerial and leadership skills on

the part of school leaders. This includes the ability to manage change, overcome resistance, and build consensus among stakeholders, aligning with Vallance's (2008, cited in Blignaut, 2010) emphasis on robust change management skills as a critical element of effective school leadership. Lastly, to effectively support ICT integration efforts, school leaders must demonstrate a basic level of ICT proficiency. This proficiency encompasses an understanding of ICTs' potential in education, the ability to utilize ICT tools themselves, and the competence to provide the necessary support for educators and staff. In sum, effective school leadership in the realm of ICT integration involves a visionary approach, strong managerial and leadership skills, and a foundational level of ICT proficiency.

In addition to the crucial qualities of vision, managerial skills, and ICT proficiency, school leaders also play a pivotal role in fostering a supportive school culture that embraces ICT integration (Mthanti & Msiza, 2023; Pachler, 2009). This entails creating an environment where educators feel empowered to take risks and incorporate new technologies into their teaching practices (watubana, 2023; Hennessy et al., 2010). To cultivate such a culture, school leaders can implement strategies such as encouraging staff ICT skills development, providing opportunities for educators to enhance their ICT proficiency through professional development programs and workshops. Furthermore, celebrating ICT successes by recognizing and applauding educators who effectively integrate ICTs into their teaching contributes to a positive and encouraging atmosphere. Additionally, school leaders must ensure that educators have access to the necessary ICT resources and support required for effective integration into their classrooms. In essence, beyond the foundational leadership qualities, the active promotion of a supportive school culture by school leaders is instrumental in facilitating successful ICT integration.

In contrast, school leaders who lack an ICT vision or demonstrate apathy towards ICTs can hinder the integration process (Czerniewicz et al., 2006; Ndukuba et al., 2018; White Paper on E-Education, 2004). School leaders must be actively involved in ICT integration efforts and demonstrate a willingness to learn about and use new technologies themselves.

To effectively implement ICTs in schools, school leaders must also possess strong leadership qualities, including initiative, ownership, and the ability to work collaboratively with educators and stakeholders (Wilmot, 2024; Steyn et al., 2014). School leaders who actively participate in ICT training, share their enthusiasm, and involve the School Governing Body (SGB) and parents are more successful in promoting ICT integration.

In conclusion, political will and school leadership are indispensable factors for successful ICT integration in education. Political leaders play a crucial role in creating a supportive environment

for ICT adoption, while school leaders serve as catalysts for innovation, promoting ICT integration into classroom practices and fostering a supportive school culture. By cultivating strong political will and effective school leadership, the integration of ICTs in education can be realized, enabling transformative teaching, and learning experiences for all learners.

2.8.2 *One size fits all: The limitations of a universal approach to ICT integration in South African schools*

The concept of "one size fits all" in ICT integration in teaching and learning in South African schools refers to the potential pitfalls of adopting uniform approaches or solutions without considering the diverse contexts, needs, and challenges present in the country's educational landscape. South Africa, with its rich cultural and socio-economic diversity, faces unique circumstances that require careful consideration in the integration of ICTs in education.

Various studies emphasize the importance of recognizing the contextual nuances in ICT integration. Vandeyar (2013) and Padayachee (2017) highlight the persistent gap between policy expectations and the actual ICT competencies of educators in South Africa. This suggests that a standardized approach to professional development and ICT implementation may not effectively address the specific challenges faced by educators in different regions or with varying levels of experience.

The digital divide, often exacerbated by economic disparities, adds another layer to the complexities of ICT integration in South African schools (Warschauer & Healey, 1998; van Dijk, 2005). Adopting a uniform approach may inadvertently widen existing inequalities, as schools with limited resources might struggle to keep pace with those that are better equipped.

Additionally, the linguistic and cultural diversity of South Africa's learner population necessitates an approach that acknowledges and incorporates these differences in the design and implementation of ICT initiatives (Herselman & Britton, 2002; EdTech Hub, 2020). Ignoring the diverse linguistic backgrounds and cultural contexts of learners may lead to the exclusion of certain groups, hindering the effectiveness of ICT integration efforts. The effectiveness of ICT pedagogical integration also requires tailoring educational content and strategies to align with the local context and curriculum goals (Monareneg et al., 2020; Strydom & Thomson, 2005; du Plesis & Webb, 2012). This suggests that a standardized curriculum or set of ICT tools may not fully address the specific learning needs and objectives of learners across different regions in South Africa.

In addressing these challenges, it becomes crucial to adopt a more flexible and contextually sensitive approach to ICT integration in South African schools. This involves recognizing and

accommodating the diverse needs of educators and learners, providing targeted professional development that considers existing competencies, and ensuring equitable access to ICT resources across all schools. Tailoring strategies to local languages and cultural contexts can enhance the relevance and effectiveness of ICT integration, contributing to more inclusive and equitable educational outcomes.

In conclusion, the "one size fits all" approach to ICT integration in teaching and learning in South African schools may not effectively address the diverse challenges present in the country's educational landscape. To overcome these challenges, policymakers and education leaders should prioritize contextually sensitive strategies that consider the unique needs, linguistic diversity, and socio-economic factors shaping the educational experiences of learners and educators in South Africa. Such an approach, guided by evidence-based practices and continuous evaluation, can contribute to more meaningful and equitable ICT integration in the South African educational system.

2.8.3 Professional development in ICT integration

Effective professional development (PD) remains paramount in unlocking the transformative potential of ICTs in education (Motebele, 2020; DoE, 2004; Mishra & Koehler, 2006; Spenner, 2005). As the White Paper on e-Education (DoE, 2004) rightly emphasizes, PD fosters a culture of ICT innovation and cultivates educators' ICT competencies. However, a concerning gap persists between policy aspirations and educators' actual ICT skills (Kwon & Park, 2023; Hart, 2023; Vandeyar, 2013; Padayachee, 2017; Ndlovu, 2015; Dzansi & Amedzo, 2014; Evoh & Fellow, 2009; Herselman & Britton, 2002; EdTech Hub, 2020). This calls for a critical examination of current PD approaches and the development of more effective strategies. Beyond mere facilitators, educators are the primary mediators between technology and learners (Liu & Zhang, 2024; Fullan, 1991). Their proficiency in ICT skills significantly impacts technology effectiveness (Alieto et al., 2024; Lisene, 2017). This intricate relationship between educators' ICT skills, classroom technology integration, and learner development forms the core of this section. Notably, it also explores the interconnectedness of key educational theories - behaviorism, cognitivism, constructivism, and social learning - with effective ICT use in education. Unlocking the true potential of ICTs demands a meticulous examination of current PD initiatives. The transformative impact hinges on cultivating educators' ICT skills, the cornerstone for shaping instructional strategies and integrating technology into their pedagogical approaches (EdTech Hub, 2020; Padayachee, 2017). Proficient educators can confidently navigate digital tools, create engaging content, and orchestrate interactive learning experiences (Roelofs, 2024; Lisene, 2017). Acquiring and refining these skills lies at the heart of effective PD, ensuring educators can leverage ICTs for educational enrichment. The persistent gap between envisioned policy outcomes and educators'

actual ICT competencies necessitates immediate action (Alenezi, 2024; Vandeyar, 2013; Padayachee, 2017). Bridging this gap and unlocking the transformative potential of ICTs requires providing educators with tailored and effective PD opportunities. As Fullan (1991) emphasizes, these opportunities should be customized to address educators' specific needs, empowering them with relevant tools and support for effective ICT integration. This shift from mere technical training fosters a deeper understanding of how to leverage ICTs for pedagogical innovation and enhanced learner engagement.

In emphasizing the imperative for educators to acquire comprehensive technological knowledge, Celik (2023) and Lisene (2017) underscores that proficiency extends beyond technical competence, encompassing a nuanced understanding of the effective integration of ICTs into teaching practices to enhance both pedagogical and content knowledge. This perspective aligns with the advocacy for a paradigm shift in teaching methods, as promoted by Nabung & Guna, (2024); Lisene (2017) and Papert (1997), aiming to equip learners with essential skills for the 21st century. The integration of ICTs into teaching and learning is positioned as a transformative solution for educational reform, with the potential to enhance learner engagement, improve learning outcomes, and prepare learners for the demands of the 21st-century workforce (Nabung & Guna, 2024; Cuban, 2001; Mishra & Koehler, 2006; Prensky, 2001). However, despite the widespread adoption of ICTs, their full potential in schools remains largely unrealized (Jasmine & Zahra, 2024; Hew & Brush, 2007; Oliver, 2012 and Wiliam, 2011). The gap between the envisioned transformative impact of ICTs and their current utilization underscores the need for strategic interventions and comprehensive professional development (PD) initiatives to align educators with the dynamic possibilities that ICT integration holds for educational advancement.

Several factors contribute to the unfulfilled promise of ICT integration in education. Inadequate design and implementation of PD, failing to provide educators with the necessary understanding, practical skills, and sustained support, constitute a key factor in this discrepancy (Nettey, 2024; Cabellos, 2024; Raja, 2024; Fullan, 1991; Hew & Brush, 2007; Kozma, 2005). Furthermore, the lack of alignment between PD and educators' specific needs and contexts, coupled with limited ongoing support and resources, impedes the sustainability of PD efforts (Abedi, 2023; Lomos et al, 2023; Fullan, 1991; Guskey, 2002; Timperley & Cook, 2000; Cobb et al., 2003; Hargreaves, 1994). Addressing these challenges requires a reevaluation of PD design and implementation, ensuring that it provides educators with not only technical skills but also a deep understanding of how to effectively integrate ICTs into their teaching practices. Additionally, ongoing support and resources tailored to educators' needs are crucial for sustaining the transformative potential of ICT integration in education.

Addressing these challenges requires a focus on deep understanding and practical skills in PD programs, tailoring PD to educators' needs and contexts, providing ongoing support and resources, fostering a culture of ICT innovation, investing in high-quality PD, and conducting regular evaluations to assess effectiveness and identify areas for improvement. By implementing these recommendations, policymakers, education leaders, and PD providers can collaboratively bridge the gap between the promise and reality of PD in ICT integration, empowering educators to leverage the transformative power of ICTs for enhanced teaching and learning outcomes (Kwon & Park, 2023; kilag et al., 2023; Cobb et al., 2003; Hargreaves, 1994; Timperley & Cook, 2000). In educational settings, the effective integration of ICTs hinges critically upon understanding diverse learning theories. This is because the methods employed by educators to transmit knowledge directly impact learner engagement and the potential for effective technology integration. By aligning their instructional approaches with relevant theoretical frameworks, educators can leverage the power of ICTs to enhance knowledge acquisition and cultivate diverse learning outcomes.

Rooted in the understanding of internal mental processes, cognitive development theory explores how learners actively construct knowledge, solve problems, and develop critical thinking skills through interaction with their environment, directly impacting how educators leverage ICT tools. Interactive simulations, multimedia presentations, and online resources offer diverse cognitive engagement opportunities, catering to individual needs and learning style. As a prominent theory in education, cognitivism delves into the internal mechanisms of learning, encompassing perception, memory, problem-solving, and critical thinking. It shifts the focus from observable behaviors traditionally championed by behaviorism, to the intricate workings of the mind., Rooted in the works of prominent theorists such as Jean Piaget, Lev Vygotsky, and Jerome Bruner, cognitivism shifts the focus from observable behaviour, as in behaviourism, to the intricate workings of the mind. This approach asserts that learners actively engage with information, organize it into meaningful structures, and connect new knowledge to existing mental frameworks.

Within the cognitive development domain, Piaget's stages – from sensorimotor to formal operational – have profoundly shaped our understanding of how learners progressively acquire increasingly complex cognitive abilities (Piaget, 1954). In contrast, Vygotsky's sociocultural theory emphasizes the crucial role of social interaction and cultural context, highlighting the zone of proximal development (ZPD) as the learning zone where support from more knowledgeable individuals fosters growth (Vygotsky, 1978).

Delving deeper into the "cognitivist approach" necessitates examination of how learners process information, construct knowledge, and cultivate problem-solving skills (Clark & Mayer, 2023). This focus on internal mental processes demands instructional strategies that stimulate critical

thinking, metacognition, and deeper understanding (Yassin, 2024; Schunk, 2012). Additionally, Bruner's spiral curriculum advocates for revisiting and reinforcing concepts over time, solidifying long-term retention (Ambrose et al., 2010; Bruner, 1960).

Technology plays a pivotal role in facilitating cognitivist principles. ICT provides personalized learning experiences through tools and platforms that promote active engagement and knowledge construction (Gupta et al., 2024; Hedberg & Starbuck, 2001). Interactive simulations, multimedia presentations, and educational software resonate with cognitivist principles by offering opportunities for exploration, discovery, and hypothesis testing (Albus, 2023; Hannafin & Land, 2000). Online collaborative platforms further fuel social interaction, fostering cognitive skill development through peer discussion and knowledge sharing (Chang & Wongwatkit, 2024; Stahl, 2013).

Within this "cognitivist paradigm," ICT transforms into a catalyst for problem-solving and critical thinking. Educational applications, virtual laboratories, and simulations empower learners to experiment, make connections, and engage in authentic problem-solving scenarios (Jonassen, 2003). Moreover, integrating ICT tools paves the way for adaptive learning experiences that cater to individual cognitive abilities and preferences, maximizing learning potential for all (Wizaiack &Santos, 2021; Gu, Holly, Lillicrap & levine, 2017).

Moving beyond theoretical understanding, exploring the cognitivist approach and the role of ICT in learning necessitates delves into practical applications and empirical research (Jo & Joo, 2011). Examining case studies, conducting original research, and analyzing existing implementations can bridge the gap between theory and practice. Jonassen (2013) asserts that aligning technology with cognitivist principles enhances the pedagogical landscape, empowering educators with innovative tools to foster cognitive development and create enriching learning experiences. As the field of education continues to evolve, cognitivism remains a dynamic and influential framework, enriched by the integration of ICT and ongoing discourse surrounding its limitations and alternative perspectives (Mayer, 2020).

Behaviourism, another prominent learning theory founded by John B. Watson and further developed by B.F. Skinner, underscores the significance of observable behaviours and acquisition through conditioning processes, including stimulus-response dynamics, reinforcement, shaping, and generalization (Hayes & Hayes, 1995; Skinner, 1958). Despite its traditional application in controlled environments, behaviourism can be effectively integrated with ICT tools to facilitate personalized learning. This integration involves adaptive software platforms for personalized learning experiences (Ouariach &Khaldi, 2024; Kulik & Fletcher, 2016), interactive simulations

and gamification strategies in games (Gil-Aciron, 2024; Sailer, Hence, Mayr & Mandl, 2017), and online drills with instant feedback for skill mastery (Skinner, 1958). These applications align with behaviourist principles, offering opportunities for reinforcement and shaping within educational contexts. While behaviourism provides valuable insights into observable behaviours and conditioning, it has been criticized for potentially oversimplifying the learning process by neglecting the influence of internal cognitive processes and the diverse learning styles and experiences of individuals (Mayer, 2020; Schunk, 2012; Pink, 2011). Extrinsic motivation through rewards, although effective for initial skill acquisition, may not sufficiently foster intrinsic curiosity and long-term engagement (Deci & Ryan, 2000). Moreover, the transferability of skills learned in controlled environments to complex, real-world contexts may pose challenges (Schunk, 2012). Behaviourism emphasizes observable behaviours and conditioning provides valuable insights for educational technology when thoughtfully integrated with other perspectives and considerations of its inherent limitations. Furthermore, educators' proficiency in ICT aligns with behaviourist principles as they can use technology to provide immediate feedback and reinforcement. Gamification, online quizzes, and interactive simulations are tools that support behaviourist learning strategies, allowing educators to shape and reinforce desired behaviours. Additionally, the tracking and assessment capabilities of technology enable educators to monitor individual progress, facilitating personalized learning experiences.

The "cognitive-behavioural link" acknowledges a connection between behaviourism and cognitivism (Beck, 2020), recognizing that while behaviourism concentrates on observable behaviours, these are influenced by underlying cognitive processes. In the context of learning, behaviourism may focus on external behaviours exhibited in response to stimuli, while cognitivism delves into the cognitive processes occurring internally during learning, such as how learners perceive, interpret, and store information.

While both cognitivism and behaviourism have made significant contributions to understanding learning, several notable critics have challenged their limitations and proposed alternative perspectives (Vygotsky, 1978; Bruner, 1966; Ansubel, 1968). Vygotsky challenged Piaget's emphasis on individual development by arguing that social interaction and cultural context play a crucial role in shaping cognition, thus introducing the zone of proximal development (ZPD) to highlight how learning occurs through guided interaction with others (Vygotsky, 1978). Bruner (1966), while contributing to cognitive theory, recognized its limitations and stressed the importance of social interaction and cultural context in learning, advocating for a constructivist approach where learners actively build knowledge through experience and social interactions. Whilst Ausubel (1968), a proponent of meaningful learning theory, criticized cognitivism for neglecting prior knowledge and meaningful connections. He emphasized the need for learning activities that build upon existing knowledge and promote understanding, not just rote

memorization. On the contradictory, Bandura (1977) who introduced the social cognitive theory challenged the deterministic nature of behaviourism, by arguing that individuals are not passive recipients of their environment but actively observe, learn, and influence their surroundings. He introduced the concept of observational learning, highlighting how individuals can acquire new behaviours through observing others. However, Chomsky (1959) argued that behaviourism's stimulus-response paradigm could not explain complex human language acquisition and behaviour. He emphasized the role of innate cognitive structures and mental processes in learning. Humanistic psychologists (Maslow, 1954; Rogers, 1961) criticized behaviourism for neglecting the emotional and social needs of individuals. They argued that learning should foster personal growth, self-actualization, and positive human development, not just observable behaviour modification. Learning theories offer valuable insights into the dynamic interplay between individual characteristics, cognitive processes, and environmental factors that contribute to effective learning, guiding effective pedagogical practices. Though cognitivism and behaviourism have provided valuable frameworks for understanding learning, their focus on internal mental processes and observable behaviours, respectively, may not fully capture the complexities of learning in contemporary educational settings. This has spurred the development of alternative theories, such as constructivism, which emphasize the dynamic interplay between learners, their environment, and social interactions in knowledge construction. This holistic and learner-centered approach resonates better with the collaborative, technology-rich environments that characterize 21st-century education.

The effective integration of ICTs into education relies on educators' adeptness in seamlessly incorporating technology into meaningful learning experiences (Mishra & Koehler, 2006). Educators with advanced ICT skills can design interactive lessons, leverage multimedia resources, and establish collaborative learning environments. Within this framework, learners actively participate in the learning process, utilizing prior knowledge and engaging in social interactions to construct their understanding (Schunk, 2012). This learner-centered approach aligns with the transformative potential of ICTs in education. Drawing inspiration from Vygotsky's sociocultural theory and Bruner's spiral curriculum, constructivism underscores the active construction of knowledge through experiential learning, interaction, and reflection (Bruner, 1966; Vygotsky, 1978). These principles advocate for a pedagogical approach that emphasizes learners actively constructing knowledge through their interactions with the environment (Bruner, 2009)

Traditionally, knowledge transmission followed a static, educator-centered approach. However, constructivism, championed by theorists like Piaget and Vygotsky, challenges this view (Piaget, 1995; Vygotsky, 1978). It posits that learners actively construct their understanding through

exploration, interaction, and social collaboration. Technology-rich classrooms actively foster these principles.

ICT tools play a transformative role in facilitating constructivist learning. They facilitate exploration and discovery, allowing learners to delve into complex concepts through simulations and virtual environments, fostering a depth of understanding beyond what passive textbook learning offers (Mayer, 2020). Similarly, they promote Interaction and Collaboration, as online platforms enable effective communication and knowledge sharing among peers, enriching individual learning experiences by exposing learners to diverse perspectives and fostering collective problem-solving skills (Jeong & Hmelo- Silver, 2016). Additionally, these tools contribute to the Construction of Personal meaning, enabling learners to curate information from various sources, subject it to critical analysis, and synthesize it into their unique understanding of the world (Greenfield & Bruner, 1966). In essence, ICT tools serve as catalysts for a more interactive, collaborative, and personally meaningful learning experience within the constructivist framework. However, the abundance of information online also presents challenges. The validity and reliability of online sources require the development of critical thinking skills to discern fact from fiction. This underscores the crucial role of educators in guiding learners to navigate the digital landscape responsibly and effectively evaluate information.

Constructivism offers a dynamic and learner-centered approach to education, empowering individuals to construct their knowledge through exploration, interaction, and critical thinking. ICT tools serve as powerful facilitators in this process, fostering deeper engagement, collaboration, and personalized learning experiences (Alam, 2016; Bonk & Cunningham, 2012). Nevertheless, responsible use and critical evaluation of information remain essential elements for navigating the complexities of the digital world and ensuring the success of constructivist learning in the 21st century.

Whilst constructivism emphasized the active role of learners in constructing knowledge through experience, reflection, and social interaction, Siemens (2017) and Downes (2005) support the concept of connectivism, that views learning as a process of creating connections in networks of information, both human and technological.

The intricate relationship between ICT learning theories and the professional development of educators underscores the need to comprehend how theories such as constructivism and connectivism inform the use of ICT in fostering social learning and knowledge acquisition. Constructivism, emphasizing active knowledge construction through experience, reflection, and social interaction, aligns with the potential of ICT in education (Bruner, 1966; Vygotsky, 1978).

Social learning theories posit that knowledge acquisition occurs through social interactions and collaboration (Bandura, 1977). Educators with advanced ICT skills can leverage online spaces to foster community and shared learning experiences, aligning with the socio-constructivist idea that learning is a social process facilitated by technology (Mishra & Koehler, 2006). The concept of "socialist development" in education, encompassing equity, critical thinking, social awareness, collaboration, and collective learning (UNESCO, 2011), can be facilitated by ICT, addressing challenges such as the digital divide and biases (Warschauer, 2004). Acknowledging the pivotal role of educator professional development in maximizing ICT's potential, efforts should target pedagogical training, technical literacy, critical ICT analysis, and fostering community collaboration among educators (Tschofen & Mackness, 2012).

Connectivism, as theorized by Siemens (2005) and Downes (2007), sees learning as creating connections in networks of information, human and technological. ICT acts as a catalyst for connectivity learning, providing access to vast information networks and facilitating collaboration through digital tools (ISTE, 2023). Effective integration requires continuous professional development for educators to adeptly leverage digital tools, create meaningful online learning environments, and guide learners through the complexities of the digital information landscape.

The interconnectedness of learning theories, ICT implementation, and educator development holds significant implications for successful ICT integration in schools. Embracing constructivist and connectivity principles amid the challenges and opportunities of technology necessitates ongoing PD for educators. By equipping themselves with necessary skills and pedagogical approaches, educators can harness ICT's power to foster diverse learning experiences, catering to individual and collective needs within various educational contexts.

Although the South African White Paper on e-Education recognizes the importance of professional development (PD) for educators, its focus on administrative systems implementation overshadows the crucial aspect of pedagogical ICT integration, identified as a major challenge in schools (Nettey et al., 2024; Cabellos et al., 2024; Vandeyar, 2013; Strydom & Thomson, 2005). This gap hinders the realization of effective ICT integration in classrooms and limits its potential to transform learning. As Fullan (1991) cautions, relying solely on traditional "workshop-and-go" PD approaches often fails to translate into meaningful changes in teaching practices. This lack of deep, practical, and sustained skill development remains a primary hurdle to effective pedagogical ICT integration.

Addressing this gap requires a shift towards PD programs designed to foster deep understanding, practical skills, and sustainable implementation of ICTs in classrooms (Kwon & Park, 2023; Hart,

2023). While the White Paper's emphasis on PD has made some progress, the persistent disconnect between policy and educators' actual ICT competencies necessitates comprehensive programs that empower them with the necessary knowledge, skills, and ongoing support (Hart, 2023; Cobb et al., 2003; Hargreaves, 1994; Timperley & Cook, 2000). Effective ICT integration goes beyond mere technology use; it harnesses its transformative power to reimagine teaching and learning, empower learners, and equip them with the critical skills and competencies needed to thrive in the 21st century (Prensky, 2001).

2.8.4 Educator perspectives and orientations

The integration of ICTs in educational practices is marked by discernible inconsistencies, reflecting the divergent attitudes among educators regarding its implementation. Educators, imbued with their own interpretations and pedagogical beliefs, shape their perceptions of teaching based on deeply rooted convictions, attitudes, agency, and volition (Vandeyar, 2013). These foundational beliefs significantly influence the "instructional setting," thereby impacting their judgments and decisions on instructional methodologies, choice of teaching strategies, and the selection of resources for content delivery (Almusalam, 2001, as cited in Khan et al., 2012).

The incorporation of technology to enhance learning hinges upon educators' beliefs concerning the value of technological integration in teaching and learning processes (Mayer, 2020; Smith, 2020; Ertmer, 2005; Nkula and Krauss, 2014; Ndlovu and Moll, 2016; Mumtaz, 2000). According to Cabellos et al., 2024 and Vandeyar (2013), educators' attitudes toward ICT implementation are further shaped by their professional identities and a commitment to enhancing the teaching and learning experience. The attitudes toward the pedagogical integration of ICTs are also associated with varying levels of ICT competence, which, in turn, influence educators' confidence in utilizing ICTs (Pozas, Letzel & Frohn, 2024; Banks et al., 1999; Sanber, 2007).

The potential for behavioral change among educators’ hinges on their proficiency in ICTs, cultivated through appropriate training. While Cabellos et al. (2024) and Khan et al. (2012) argues that positive attitudes towards technology facilitate motivation for skill acquisition, even among educators with limited ICT competencies, a positive outlook fosters a willingness to learn and integrate technology in the classroom. Conversely, negative attitudes act as deterrents, discouraging educators from incorporating technology into pedagogies and hindering the acquisition of essential ICT skills (Harrison and Rainer, 1992, as cited in Khan et al., 2012). Educators with negative computer attitudes often lack the requisite ICT skills and are less inclined to adapt their teaching methodologies to include technology, in stark contrast to their counterparts with positive computer attitudes.

Additionally, in the contemporary landscape of primary education, the dichotomy between Net Generation educators and their predecessors, often referred to as the "Old Guard," in terms of integrating ICTs into classrooms has become a focal point of interest. Net Generation educators, born and raised in the digital era, exhibit a natural affinity for technology, seamlessly incorporating it into their teaching methodologies (Geeraerts,Vanhoof & Van den Bossche, 2018). Their fluency in digital tools, social media, and interactive platforms positions them as adept navigators of the information age, allowing for a more dynamic and engaging learning environment. On the contrary, the Old Guard, while possessing extensive pedagogical experience, may grapple with the rapid evolution of technology, potentially leading to a reluctance or slower adoption of ICT in the classroom (Kumar & Rani 2016). However, it is crucial to recognize that the dichotomy is not absolute, as some traditional educators may successfully bridge the gap by embracing professional development opportunities (Tshimanika et al., 2022; Khan et al., 2012).

The challenges faced by older educators in the integration of ICT in primary schools can be attributed to various factors, categorized into Lack of Confidence and Skillset, Pedagogical Concerns, Institutional Barriers, and Psychological Factors. Limited exposure to technology during their formative years may lead older educators to feel intimidated by the perceived complexity of ICT tools (Tallvid, 2016). Additionally, insufficient training within traditional educator education programs often leaves them feeling unprepared for the demands of a technologically enhanced classroom. The fear of failure, stemming from the steep learning curve associated with new technologies, can act as a significant deterrent, as educators may worry about technical glitches or making mistakes during implementation. Pedagogical concerns arise from a preference for established, non-digital teaching methods, with some educators believing that traditional approaches, such as textbooks and lectures, are more effective. Furthermore, worries about technology-induced distractions for learners and a perceived loss of control in the dynamic digital learning environment contribute to resistance. Institutional barriers, encompassing limited access to resources, a lack of technical support, and rigid curriculum frameworks, pose significant obstacles to widespread ICT integration. Psychological factors, including comfort in familiar teaching methods, time constraints, and age-related stereotypes, further compound the challenges faced by older educators in adapting to and embracing technology in primary education settings. Understanding and addressing these multifaceted issues are crucial for fostering a more inclusive and effective integration of ICT in primary schools.

Hence, the effective integration of ICTs in classrooms is contingent upon educators' beliefs and attitudes, underscoring the imperative to cultivate a positive mindset towards technology. Mere policy formulation and the provision of technological resources do not guarantee ICT integration; rather, the transformative process necessitates a shift in educators' mindsets to embrace this

evolving mode of teaching (Cabellos et al., 2023; Tshimanika et al., 2022; Troure et al., 2008; Vandeyar, 2013; Tamin et al., 2015).

2.8.5 Financial considerations

In the contemporary educational landscape, efforts to enhance ICT utilization in classrooms vary significantly among schools. While strides are being made by certain educational institutions to improve their ICT infrastructure and instructional methodologies, a discernible divergence exists in the prioritization of educational needs, owing to the financial context of schools. The observations align with the findings of Vale & Graven (2023); Munje & Jita (2020) and Dzansi and Amedzo (2014), who assert that the variations in financial resources contribute to an exacerbation of the digital divide, thereby creating disparities in ICT access and integration among schools. This study underscores the crucial role of financial considerations in shaping the digital landscape within educational institutions in South Africa. Schools with limited financial resources may find themselves constrained in their ability to invest adequately in ICT infrastructure, educator training, and technological resources essential for effective integration into pedagogical practices. Consequently, such financial constraints perpetuate a digital divide, creating a bifurcation between schools that can afford robust ICT implementation and those that grapple with resource deficiencies.

South Africa's amended National Norms and Standards for School Funding (NNSSF) establish a quintile system that categorizes public schools into five socioeconomic bands based on poverty indicators which directly impacts on school fees and resource allocation (Mokate, 2023; Spaull, 2013). Quintiles 1 and 2 represent the 40% most disadvantaged schools, designated as "no-fee" (Department of Basic Education, 2006). Conversely, Quintiles 3, 4, and 5 cater to progressively less disadvantaged communities, allowing them to charge school fees alongside government funding. Quintile 1 comprises the 20% poorest schools, receiving the highest per-learner allocation from the government, while Quintile 5 represents the least disadvantaged and the allocation is lowest from other quintiles (Department of Basic Education, 2006). The premise for this differential funding aims to address historical inequalities and promote equal opportunities through resource allocation (DoBE, 2006). However, the landscape reveals complexities beyond this straightforward demarcation. Notably, Quintile 1 and 2 schools cater for learners located in poorer communities (Van der Berg, 2008), yet many learners from these disadvantaged communities, who cannot afford fees, attend Quintile 3-5 suburb schools (Maistry, 2020). This creates a situation where "no-fee" schools face resource constraints due to high learner numbers and diverse needs whilst the fee- paying schools struggle to accommodate these learners, who may be exempted from paying school fees, as per the basic rights “every child must be educated”. Fee exemptions further complicate the equation. Many Quintiles 3-5 schools struggle with a

significant portion of parents who qualify for full or partial fee exemptions, straining their financial resources (Maistry, 2020). Additionally, fee structures within each quintile vary according to individual school governing body decisions, exacerbating disparities. This results in stark differences in resource availability, ICT integration, and overall learning opportunities (Bisschoff & Mestry, 2009). While some schools possess the infrastructure and expertise for ICT integration, others struggle to meet basic operational needs, widening the digital divide within and across quintiles.

The system's implications for ICT integration further highlight its complexities. While Quintile 1 schools receive dedicated ICT budgets, challenges persist (van der Berg, 2008), such as inadequate infrastructure, limited educator training, and unreliable internet connectivity (Maistry, 2020). These hurdles often render allocated resources ineffective, raising concerns about the system's ability to address the digital divide and ensure equitable access to ICT-enabled learning across quintiles (Sithomola, 2021). School budgets prioritize crucial elements like educator salaries, textbooks, and basic utilities. ICT, unfortunately, gets relegated to the periphery, particularly in underprivileged communities. This budgetary squeeze manifests in several critical areas that include challenges to equip every learner and classroom devices. Limited funds force schools to ration their hardware, hindering equal access and effectively curtailing ICT-driven activities. Additionally, essential educational software, which is the fuel for enriching lessons, comes at a cost, further tightening already strained budgets (Munje & Jita, 2020; Ramorola, 2013). Schools are often left navigating the inconsistent use of open-source alternatives, which, while commendable, may lack the specialized features crucial for effective context-based learning (Meyer et al., 2016). Furthermore, connectivity which is the bridge to the digital world can be prohibitively expensive. High-speed broadband remains a luxury for many schools, leaving them with slow, unreliable connections or even complete isolation from the online world, hampering online learning initiatives and isolating them from the vast information landscape.

Availability of resources is just not good enough on its own, instead it requires ongoing upkeep, upgrade, and update (Munje & Jita, 2020). This ICT ecosystem has financial implications. ICT resources succumb to wear and tear. Repairs and replacements have budgetary implications often leading to a vicious cycle of malfunctioning equipment further crippling ICT integration (Ramorola, 2013). Then, software licenses require periodic updates that requires a budget. Limited budgets can force schools to postpone or neglect these updates, leaving them vulnerable to cyber threats and compromising the very efficiency of the technology. Furthermore, maintaining a complex ICT network requires skilled navigators. Schools, often with understaffed IT

departments, are forced to rely on expensive outsourced services, adding another layer of strain on already stretched budgets (Mabila, Van Biljon & Herselman, 2017).

Inadequate funding not only constraints the ICT ecosystem of resources but also weakens the very foundation upon which it rests (Chisango & Marongwe, 2021; Dzansi & Amedzo, 2014). Unreliable electricity in some areas throws ICT initiatives into darkness. Schools are forced to depend on costly backup generators or other power supply systems that must extend across the entire school, or simply abandon technology when the power fades (Blimpo & Cosgrove-Davies, 2019). Then, security Shortfalls are prominent in many public South African schools. Protecting valuable equipment and sensitive data requires robust security systems. However, budgetary constraints often force schools to compromise on security, leaving them vulnerable to theft, damage, and cyberattacks. Again, adapting classrooms to accommodate ICT requires rewiring, furniture adjustments, and proper ventilation for the increased heat generation (Munje & Jita, 2020). This seemingly mundane infrastructure becomes a formidable obstacle due to lack of funds, preventing the full utilization of ICT in the learning environment.

Financial constraints cast a long shadow on the integration of ICT in South African schools. The impact on maintenance, infrastructure, and overall effectiveness cannot be ignored. Yet, amidst this scarcity, there are glimmers of hope. Through a united effort, by leveraging increased government support, forging public-private partnerships, embracing creative solutions, and engaging the community, we can break the chains of financial constraints and build a future where all schools, not just the fortunate few, can cultivate a thriving ICT ecosystem that empowers our learners to blossom in the digital age (Mabila, Van Biljon, & Herselman, 2017).

The assertion that the South African Government should adopt a more proactive stance gains prominence in this discourse. It is imperative for the government to establish comprehensive structures and frameworks that facilitate the seamless integration of ICTs across all schools in the country. This necessitates not only policy initiatives but also a commitment to adequate funding mechanisms that enable schools, particularly those in financially challenged contexts, to embrace and effectively implement ICT in their educational processes.

The call for increased financial provisions is grounded in the understanding that the successful integration of ICTs demands not only policy advocacy but tangible support in the form of financial resources. Adequate funding would empower schools to bridge the digital gap, ensuring that all learners, regardless of their socio-economic backgrounds, have equitable access to the benefits of ICT-enhanced learning (Chisango & Marongwe, 2021). Therefore, a strategic and

sustained financial commitment from the government is paramount to narrowing the digital divide and fostering a more inclusive and technologically adept educational landscape in South Africa.

2.8.6 Time constraints and its implications for integrative ICT lessons in education

The execution of integrative lessons utilizing ICTs demands a considerable investment of time, encompassing various facets of instructional planning and delivery. Delving into the nuances of this temporal commitment, educators engaging in integrative ICT lessons are tasked with conducting comprehensive research using the internet, deliberating on the selection and optimal utilization of technology, employing suitable programs to facilitate lesson delivery, identifying, and procuring pertinent learning materials, and strategizing on the integration of diverse tools and methods to effectively prompt learners in constructing their own learning experiences.

This temporal demand associated with integrative lessons has been underscored in extant literature. Lomos et al. (2023); Kilag et al. (2023); Becta, 2004 as cited in Bingimlas (2009); and Tearle (2004) collectively emphasize the extensive time investment required for the successful implementation of integrative ICT lessons. Chisango & Marongwe (2021) and Sicilia (2005), as cited in Bingimlas, 2009) accentuates that these integrative lessons necessitate heightened effort and time compared to traditional instructional methods. Consequently, a predilection among educators toward traditional teaching methods over ICT content integrative lessons is observed.

Acknowledging time as a critical resource, it becomes imperative to afford educators adequate time for exploration and expansion of their utilization of ICTs within classrooms, especially if the integrative approach to teaching is to be successfully implemented. Bingimlas (2009), Mumtaz (2000), Hennessy et al. (2010), and Jung (2005) converge on the argument that time, as a fundamental element, must be allocated to educators to enable them to navigate and assimilate ICT tools seamlessly into their pedagogical practices. Without this temporal allowance, the implementation of integrative ICT lessons may face impediments, hindering the realization of the transformative potential inherent in this pedagogical approach. In conclusion, recognizing and addressing the temporal demands of integrative ICT lessons is paramount for fostering their effective integration and ensuring the continual professional development of educators in the dynamic landscape of technology-enhanced education.

2.8.7 Infrastructure and resources: The foundation of ICT integration

The cornerstone of successful ICT integration in teaching and learning lies in the availability of adequate ICT infrastructure and resources. However, the reality in many South African schools is characterized by a lack of the necessary resources and appropriate infrastructure to effectively implement ICT in education (Kgosi et al., 2023; Ajani, 2023; Hart, 2023; Tshimanika et al., 2022 Padayachee, 2017). A well-equipped ICT infrastructure encompasses a range of elements,

including hardware, software, connectivity, and technical support. For ICT integration to thrive, schools require a sufficient supply of computers, along with their proper maintenance and upkeep, to ensure optimal functionality. Additionally, access to peripherals such as printers, projectors, and interactive whiteboards further enhances the learning environment and facilitates the effective use of ICTs.

The absence of these fundamental resources poses a significant barrier to ICT integration. Davids (2023) and Dzansi & Amedzo (2014) aptly highlight that the lack of basic infrastructure in South African classrooms often leads to the perception of ICTs as a luxury rather than a necessity. This perception stems from the inability of schools to provide the essential resources that would enable educators to effectively integrate ICTs into their teaching practices and learners to fully reap the benefits of technology-enhanced learning.

In addition to hardware and peripherals, access to reliable and affordable internet connectivity is crucial for ICT integration. Internet connectivity provides access to a wealth of digital resources, including educational software, online learning platforms, and collaborative tools, which are essential for enhancing teaching and learning. Furthermore, connectivity enables learners to engage in online research, participate in virtual discussions, and connect with peers from around the world, fostering global perspectives and cross-cultural understanding.

The availability of ICT infrastructure and resources extends beyond physical equipment and connectivity to encompass technical support services. Effective ICT integration requires ongoing technical assistance to address technical glitches, troubleshoot software issues, and provide training and guidance to educators on the use of ICT tools and resources. Without adequate technical support, schools risk facing disruptions to ICT-based lessons, hindering the smooth integration of technology into teaching and learning.

The successful integration of ICTs in South African schools' hinges on addressing the prevalent lack of adequate ICT infrastructure and resources. Providing schools with the necessary hardware, software, connectivity, and technical support is essential to create an enabling environment where ICTs can be harnessed to transform teaching and learning practices and empower learners to thrive in the digital age.

2.8.8 The Significance of Technical Support in Sustaining Pedagogical ICT Integration Projects in educational settings

In the intricate landscape of educational technology, the role of technical support emerges as a linchpin in ensuring the viability and continuity of ICT projects within schools. This assertion is

underscored by scholars such as Isaacs (2021); Vandeyar (2013), Tondeur (2010), and Goktas (2013), who collectively accentuate the instrumental nature of technical support in the sustained success of ICT initiatives. The centrality of technical support becomes especially apparent when confronted with the disruptive and demotivating impact of technical breakdowns, which can impede progress in the implementation of pedagogical ICT integration. This notion is corroborated by Hart (2023); Bingamlas (2009), Tearle (2004), Mumtaz (2000), Mirzajani et al. (2016), and Strudler (2008).

Moreover, the absence of on-site technical support is not merely a logistical concern but translates into a substantial loss of both time and financial resources, as elucidated by Lim et al. (2003). The essentiality of having technical support experts physically present within educational institutions cannot be overstated, as their immediate accessibility becomes imperative for troubleshooting and expeditious resolution of technical issues. This proactive on-site support not only mitigates potential disruptions but also ensures the seamless functioning of ICT tools and resources, thereby contributing to the sustained viability of the ICT integration process.

The successful implementation of pedagogical ICT integration is contingent upon the robust backing of technical support mechanisms. When on-site technical support is readily available, educational institutions are better positioned to navigate the challenges associated with technological breakdowns, fostering an environment conducive to the effective implementation of ICT initiatives. As such, the integration of technical support within the broader framework of pedagogical ICT initiatives emerges as a critical facet that demands strategic attention and resource allocation for the seamless fusion of technology and education.

2.8.9 Monitoring and support for effective implementation of ICT integration in schools

In the intricate landscape of educational technology, the meticulous process of monitoring and providing support to schools emerges as a cornerstone for the successful implementation of ICT pedagogical integration. As articulated by Baqir et al. (2009) and Hart (2023), the design of an ICT policy necessitates ongoing monitoring and evaluation to ensure its efficacy. Drawing insights from the implementation of ICT policy in Singapore's education system, Lim (2007) and Kozma (2011) highlight the pivotal role of regular monitoring and evaluation, coupled with iterative refinement of master plans, in achieving successful ICT integration.

Monitoring is a proactive mechanism that supports the implementation process by facilitating necessary adjustments and adaptations. Simultaneously, evaluation serves as a reflective process, delving into the outcomes of policy implementation and discerning the effectiveness of the designed strategies. This analytical approach identifies what aspects work well and where improvements are warranted within the policy design. In the context of South African education,

however, there appears to be a conspicuous absence of robust monitoring and evaluation mechanisms for ICT pedagogical integration in schools, as lamented by Hart (2023); Ajani & Govender (2023); Chris van Wyk (2012), Vandeyar (2013), and Meyer et al. (2016). Vandeyar (2013) further underscores the detrimental impact of the lack of practical enforcement of ICT policies in South African schools, impeding the ICT implementation process.

Trucano (2016) identifies monitoring and support as one of the essential themes in policy formulation. Despite the acknowledgment within the South African ICT policy (White paper on E-education, 2004) that monitoring, and evaluation are integral components (p.38), the chasm between policy design and actual implementation persists due to the deficient execution of monitoring and evaluation processes across schools in South Africa. This discrepancy raises critical concerns about the disjuncture between policy intent and practical implementation, necessitating urgent attention and rectification.

2.9 Theoretical Frameworks

The integration of ICT into South African schools holds immense promise for transforming teaching and learning, yet numerous challenges impede its optimal implementation. Exploring the key challenges and opportunities associated with this process requires a structured approach that unravels the complex interplay of factors at play. This is where the value of a research framework lies. By serving as a mental model (Stahl, 2023; Verschuren & Doorewaard, 2010), a framework acts as a lens through which to examine the research question: " What are the key opportunities that can transform the implementation of ICT pedagogical integration in South African schools?" This lens provides clarity and focus (Nowell et al., 2017) by organizing the diverse variables and relationships involved. It guides the research journey, informing the selection of appropriate data collection methods (Teddlie & Yu, 2017) and the subsequent analysis and interpretation of findings (Scharf & Smith, 2011). Furthermore, using a framework enhances the transparency and replicability of research (Denzin & Lincoln, 2023), facilitating clear communication with other scholars. Two potential types of frameworks can be considered. These are Theoretical framework and Conceptual framework. Whilst a theoretical framework leverage established theories and models (Bryman & Bell, 2011), it can offer a predefined lens for understanding the adoption and use of ICT in educational settings. Alternatively, conceptual frameworks can be crafted specifically for this research, drawing on various sources like existing research, policy documents, and stakeholder perspectives. This approach allows for a more nuanced understanding tailored to the unique context of South African schools. Selecting the most suitable framework hinges on the research question's specific nuances and the desired level of depth and flexibility. By adopting this framework-driven approach, the researcher can effectively navigate the complexities

of ICT integration in South African schools, ultimately unlocking its potential to benefit educators and learners alike.

2.9.1 Conceptual frameworks

In the realm of research, navigating a complex research question necessitates a structured guide. A conceptual framework emerges as a powerful tool, serving as a "mental model" (Verschuren & Doorewaard, 2010) that organizes key concepts, variables, and their interrelationships specific to the investigated phenomenon (Patton, 2020). This intellectual scaffolding plays a pivotal role for researchers, offering several distinct advantages. Firstly, conceptual frameworks foster clarity and focus (Nowell et al., 2017) by delineating the boundaries of the study and preventing tangential explorations. By explicitly laying out the key constructs and their anticipated connections, researchers ensure their inquiry remains relevant and aligned with the research question. This focused approach not only optimizes resource allocation but also enhances the rigor and internal consistency of the research (Denzin & Lincoln, 2023). Secondly, conceptual frameworks illuminate the path towards data collection and analysis. They guide the identification of critical variables (Polit & Beck, 2018) and inform the selection of appropriate data collection methods (Teddlie & Yu, 2017). This informed approach ensures collected data directly addresses the research question and provides a solid foundation for meaningful analysis and interpretation (Scharf & Smith, 2011).

However, utilizing a conceptual framework comes with certain implications. Unlike theoretical frameworks (Bryman & Bell, 2011) that draw upon established theories and models, conceptual frameworks are unique creations specific to each research project. This necessitates careful development and justification, drawing upon diverse sources like relevant literature, expert opinions, and even preliminary data (Strauss & Corbin, 1990). Additionally, their inherent flexibility can introduce potential subjectivity, requiring researchers to maintain transparency and reflexivity throughout the research process (Denzin & Lincoln, 2023). Therefore, employing a conceptual framework is most beneficial when investigating novel or under-researched phenomena where existing theories offer limited guidance. In such scenarios, a conceptual framework allows researchers to build upon existing knowledge, incorporate unique contextual factors, and ultimately contribute original insights to the field.

2.9.2 Theoretical frameworks

A theoretical framework is a foundational structure that guides the design, conduct, and interpretation of research studies. It comprises a set of interconnected concepts, definitions, and propositions that present a systematic view of phenomena. Grant and Osanloo (2016) advocate the indispensability of a theoretical framework, likening it to the intricate blueprint of a home construction project, encompassing detailed plans, drawings, and installations. Researchers

employ theoretical frameworks for several reasons. Firstly, they provide a lens through which researchers can interpret their findings and understand the relationships between variables. Secondly, theoretical frameworks offer a basis for generating hypotheses and research questions, facilitating the organization and integration of existing knowledge within a particular field. Thirdly, they enhance the rigor and credibility of research by grounding investigations within established theories and concepts. The use of theoretical frameworks helps researchers to conceptualize complex phenomena, identify key variables, and develop testable hypotheses, ultimately leading to more coherent and insightful research outcomes. However, selecting an appropriate theoretical framework requires careful consideration of the research context, as well as the theoretical perspectives that best align with the research aims and objectives. Despite their benefits, theoretical frameworks also present challenges, such as the potential for oversimplification or bias, the difficulty of selecting the most suitable framework from the myriad available options, and the need for researchers to critically evaluate and adapt existing theories to fit their specific research contexts. Nonetheless, when used judiciously, theoretical frameworks serve as invaluable tools for advancing knowledge and understanding within diverse academic disciplines. (Smith & Jones, 2023; Brown et al., 2022).

2.9.3 Rationale for selection of theoretical framework

Understanding the intricacies of ICT integration within South African schools demands a structured approach that navigates the complex interplay of contextual factors. Drawing upon the rich understanding of contextual factors influencing ICT integration across various levels (Ertmer, 1999), this study embraces the hypothesized theoretical framework proposed by Collis and van der Wende (2002). This research strategically employs the Collis and van der Wende (2002) framework as a theoretical lens to investigate the central inquiry, " What are the key opportunities that can transform the implementation of ICT pedagogical integration in South African schools?" Through this framework, the study sheds light on the nuanced challenges and opportunities entailed in this endeavor. The selection of this framework is not arbitrary; rather, it stems from its inherent alignment with the research context and its insightful contributions to the research process (Collis & van der Wende, 2002; Ertmer, 1999). The Collis and van der Wende framework, initially developed for Higher Educational Institutions (HEIs), offers a multifaceted perspective on ICT implementation. By dissecting various factors – from technology infrastructure and individual characteristics to leadership commitment and contextual influences – this framework resonates with the diverse realities of South African schools. This mirroring effect ensures the research remains grounded within a relevant theoretical context, fostering internal consistency and strengthening external validity**.**

Furthermore, the framework's focus on anticipating future developments based on present scenarios proves invaluable in this research. Given the dynamic nature of ICT and its constant evolution, a framework that envisions potential trajectories is crucial for understanding the evolving landscape of South African schools. This forward-looking perspective allows the research to not only identify current challenges and opportunities but also anticipate and prepare for future contingencies. Beyond its thematic alignment, the Collis and van der Wende framework provided practical benefits throughout the research process. Its comprehensive nature guided the identification of key variables for investigation, informing the development of research questions and the selection of appropriate data collection methods. Moreover, the framework served as a conceptual touchstone throughout the analysis and interpretation of findings, ensuring coherence and alignment with the established theoretical lens.

While theoretical frameworks offer numerous advantages, they also present challenges. In this instance, adapting a framework originally designed for HEIs to the context of South African schools required careful consideration of potential generalizability limitations. However, by acknowledging these limitations and critically reflecting on their implications, the research maintains its rigor and transparency and may be adapted to align with the research findings. Ultimately, employing the Collis and van der Wende framework serves as more than simply adopting a pre-existing structure. It signifies a deliberate and informed choice, harnessing the framework's strengths to illuminate the unique complexities of ICT integration in South African schools. This strategic utilization promises to yield rich insights, ultimately contributing to a more nuanced understanding of this critical educational endeavour.

2.9.4 The hypothesized model (Collis & van der Wende, 2002)

"Clusters of factors predicting current and future scenarios for ICT and educational delivery."

The study's findings revealed a complex landscape, indicating low ICT usage, sluggish change, a blend of ICTs with traditional instructions, and a dearth of strategic ICT use within HEIs. Subsequently, the hypothesized framework was devised, incorporating insights into the factors shaping technology use in HEIs, thereby predicting institutional evolution based on their current states. The framework delves into how HEIs perceive their changing environments through ICTs, the external factors influencing decision-making, and their impacts on ICT implementation. Additionally, it explores how strategic responses manifest in internal policies and implementation plans, ultimately shaping teaching and learning practices.

The research outcome underscored the significance of policy in shaping ICT implementation success, with identified factors from the literature review impacting policy effectiveness. The model predicts possible outcomes that influence the current and future scenarios for ICT

implementation. The framework comprises five sets of factors, each consisting of key components clustered in a system that depends on the preceding factor for successful operation. This sequential dependency implies that each set of clusters is expected to forecast those in the subsequent cluster.

Figure 1 shows clusters A-E, representing environmental conditions and settings, policy response, implementation, practice, and experience/effects, respectively, were instrumental in determining scenarios. Cluster A encompasses various external and internal factors, such as mission and profile, leadership types, learner needs, instructor characteristics, and external pressures, shaping the institutional environment. Cluster B, the policy response, is directed by the factors under environmental conditions and settings, influencing the current ICT policy and subsequent related policies. Cluster C pertains to the implementation process, influenced by factors in the previous clusters, including learner and instructor support, as well as the provision of infrastructure and resources. Cluster D focuses on practice, elucidating that the mere presence of technology does not guarantee its instructional use. Lastly, Cluster E, experience and effects, illustrates the culmination of preceding factors, leading to perceived or verified results that significantly influence the commitment to a particular delivery scenario. This comprehensive theoretical framework thus provides a structured lens through which to analyze and understand the intricate dynamics of ICT implementation in Higher Educational Institutions.

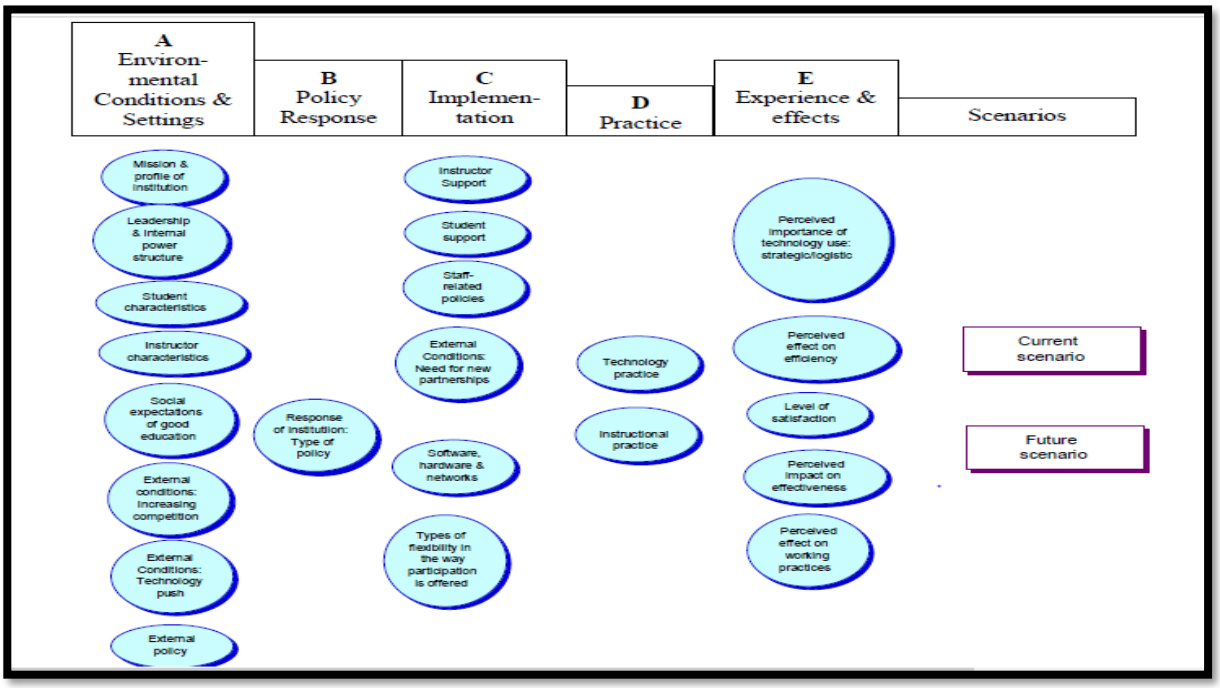

Figure 1: Hypothesized model, clusters of factors predicting current and future scenarios for ICT and educational delivery

The selection of this framework was predicated on its relevance to key features integral to this study, particularly those germane to the factors influencing ICT integration implementation and the extant state of ICT integration in educational institutions. This framework facilitates the

identification of critical factors, thereby providing schools with guidance to address specific needs essential for the successful implementation of ICT. Despite its initial design for ICT implementation in higher education institutions (HEIs), its adaptability and effectiveness were demonstrated at the school level. Consequently, during the phases of data collection and analysis, the framework underwent careful reconstruction to ensure its seamless alignment with the distinctive parameters of the educational landscape under investigation. This meticulous adjustment was imperative to maintain the theoretical framework's applicability and resonance with the intricacies of ICT implementation in schools, thus enhancing the theoretical grounding of the study.

Chapter three: Research design and methodology

3.1 Introduction

This research is a qualitative study which delves into the intricate realities of ICT integration within South African educational settings. To capture the diverse perspectives and experiences surrounding this crucial endeavor, a purposive sampling strategy was employed. This deliberate approach selected 16 participants from four strategically chosen schools: two designated as "ICT schools" with significant focus on technology integration, and two non-ICT schools representing a more traditional context. Within each school, participants encompassed educators across all educational phases (Foundation, Intermediate, and Senior) to ensure a nuanced understanding of ICT integration across developmental stages. Additionally, one school manager from each institution was included, providing valuable insights into leadership perspectives and school-wide approaches to technology use. To gather rich and detailed data, semi-structured interviews served as the primary instrument. This flexible format allowed participants to share their unique experiences and perspectives while enabling the researcher to probe deeper into specific themes and areas of interest. Hence, the research employs an interpretivist lens and a case study approach to explore the complexities of ICT integration in South African schools. Interpretivism acknowledges the social construction of experiences within specific contexts, aligning well with the case study's focus on capturing the lived experiences of educators and school managers. This approach fosters reflexivity, ensuring interpretations consider multiple perspectives and contribute to a richer understanding of ICT integration in the South African school environment.

The figure 2 provides the flow of the research methodology and the justifications thereof.

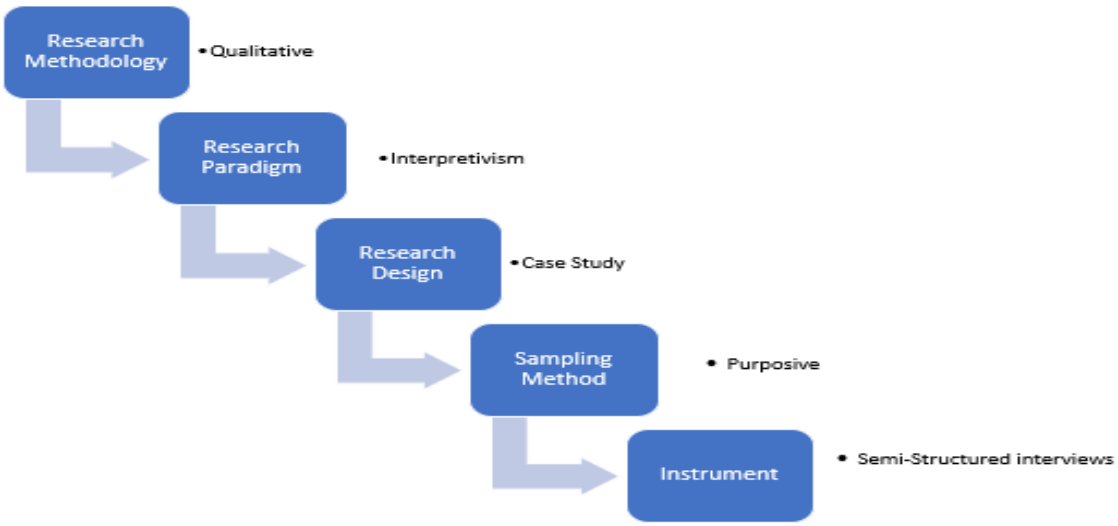

Figure 2 Flow chart of research methodology

3.2 Research method

Research methodology encompasses the systematic processes, techniques, and approaches utilized by researchers to investigate, analyze, and interpret phenomena of interest within their respective fields (Creswell & Creswell, 2017). It serves as the blueprint for conducting research, guiding researchers through the various stages of inquiry from conceptualization to dissemination of findings. Research methodology encompasses a diverse range of strategies, including qualitative, quantitative, and mixed methods approaches, each offering distinct strengths and applications depending on the research objectives and context (Bryman & Bell, 2015). Qualitative and quantitative approaches fall under the broader category of research methods within the research methodology framework. These approaches represent two primary methods used by researchers to collect and analyze data during the research process. Both qualitative and quantitative approaches have distinct characteristics, advantages, and limitations, making them suitable for different research questions and contexts (Cresswell & Cresswell, 2017). Researchers often choose between qualitative or quantitative methods based on the nature of their research objectives, the phenomena under investigation, and the desired depth or breadth of understanding (Bryman & Bell, 2015). Therefore, qualitative, and quantitative approaches are fundamental components of research methodology, guiding researchers in selecting appropriate methods for data collection, analysis, and interpretation in accordance with their research goals.

3.2.1 Quantitative research

While the exploratory qualitative approach delves into the unknown, quantitative research methodologies offer a diverse repertoire of tools for systematic and measurable investigation. By employing numerical data and rigorous statistical analysis, these approaches provide robust insights into phenomena across various disciplines. Some of the quantitative approaches include:

i. Experiments: Considered the gold standard for establishing cause-and-effect relationships, experiments manipulate variables under controlled conditions to observe their impact on another variable (Cohen et al., 2018). Think carefully designed studies evaluating the efficacy of a new drug or the influence of advertising on consumer behaviour.
ii. Surveys: A powerful tool for gathering data from large and diverse populations, surveys employ standardized questionnaires to collect information on attitudes, opinions, and behaviours (Razzaq, 2022; DeVellis, 2017). Imagine national surveys gauging public opinion on political candidates or international studies exploring consumer preferences.
iii. Observational Studies: These approaches systematically observe and record phenomena without manipulating variables. They can be longitudinal, tracking changes over time (e.g., studying the development of language in children), or cross-sectional, capturing a snapshot at a specific point (e.g., observing traffic patterns at an intersection).

iv. Content Analysis: Diving into the world of text, audio, or video, content analysis quantifies specific features or themes within the material (Krippendorff, 2018). Analyze political speeches for emotional language, track changes in media representation of specific groups, or examine social media content for sentiment analysis.

v. Meta-Analysis: This approach statistically combines findings from multiple studies on the same topic, providing a comprehensive overview and identifying stronger evidence (Pigott & Polanin, 2020; Cooper et al., 2017). Think summarizing the collective effects of various educational interventions or analysing the overall effectiveness of different cancer treatments.

While quantitative research offers a robust framework for investigating phenomena and generating empirical evidence, it is not without its limitations and challenges. Each quantitative approach has its own set of strengths and weaknesses, which must be carefully weighed considering the research objectives, context, and constraints. For instance, while experimental research allows for causal inference, it may be challenging to implement in real-world settings due to ethical or practical considerations. Correlational research, on the other hand, can identify associations between variables but cannot establish causation. Additionally, the reliance on numerical data and statistical analysis poses challenges related to measurement validity, reliability, and generalizability. Furthermore, technological advancements, while enhancing the scope and efficiency of quantitative research, also introduce new complexities such as data privacy concerns and biases inherent in big data analytics. Despite these limitations and challenges, mixed method approaches offer a promising avenue for overcoming some of these constraints by integrating quantitative and qualitative techniques to provide a more comprehensive understanding of complex phenomena (Shan, 2022; Gilad, 2021). As researchers continue to innovate and adapt quantitative methodologies to address contemporary research questions, it is imperative to remain vigilant in addressing inherent limitations and ethical considerations to ensure the rigor and integrity of quantitative research findings.

3.2.2 Qualitative approach

Qualitative research, distinct from its quantitative counterpart, offers a nuanced and interpretive approach to exploring the complex realities of human experience and social phenomena. Rejecting the notion of a single, objective reality, it delves into the subjective meanings and lived experiences of individuals and groups, weaving a rich tapestry of understanding through carefully gathered qualitative data (Creswell & Creswell, 2017).

Central to qualitative research is the researcher as an active participant. Unlike quantitative methods that strive for distance and objectivity, qualitative researchers engage in immersive data collection methods such as interviews, observations, and focus groups, actively interacting with

and learning from research participants (Denzin & Lincoln, 2023). This proximity cultivates a deep understanding of participants' perspectives, emotions, and motivations, generating rich descriptions and detailed accounts of their lived experiences.

Qualitative methods are highly diverse, each offering unique strengths and considerations. Interviews, in-depth conversations with individuals, provide access to personal narratives and insights into individual perspectives (Merriam & Grenier, 2019). Observations, direct immersion in participants' environments, capture the intricacies of social interactions and nonverbal communication (Emerson, Fretz, & Shaw, 2011). Focus groups, facilitated discussions with multiple participants, generate dynamic interactions and explore shared meanings and experiences within specific groups (Burrell & Morgan, 2019).

Qualitative research encompasses a diverse range of approaches, each offering unique strengths and insights for exploring complex social phenomena and human experiences. Some of these approaches include:

i. Phenomenology: This approach delves into the lived experiences of individuals, aiming to understand the essence of a particular phenomenon from their perspective. Methods like in-depth interviews and participant narratives are often used (Urcia, 2021).
ii. Ethnography: This immersive approach involves researchers living within and observing a particular community or group for an extended period, gaining an in-depth understanding of their culture, norms, and practices. Participant observation and interviews are key methods (Hockey & Forsey, 2020)
iii. Grounded Theory: This inductive approach builds theory from the ground up, analysing qualitative data to identify emergent themes and patterns that contribute to new theoretical understandings (Urcia, 2021).
iv. Case Study: This approach focuses on a specific case (individual, group, or event) in detail, exploring its complexities and nuances through various data sources like documents, interviews, and observations (Priya, 2021).
v. Narrative Inquiry: This approach explores individual or collective stories and narratives, analysing their construction, meaning, and impact on understanding experiences and identities. Interviews, autobiographies, and historical documents are commonly used (Clandinin, 2022).
vi. Discourse Analysis: This approach examines how language is used in social contexts, uncovering underlying power dynamics, ideologies, and societal structures within text and conversation. Documents, speeches, and social media data are often analysed (Hjelm, 2021).

vii. Arts-based Research: This approach incorporates creative methodologies like photography, filmmaking, or performance art to explore experiences and emotions in non-traditional ways, engaging multiple senses and promoting understanding beyond words (Leavy, 2022).

viii. Exploratory qualitative Research: This approach provides researchers with a flexible and in-depth means of exploring new research areas, generating hypotheses, and gaining a deeper understanding of complex phenomena from the perspectives of those directly involved. It allows researchers to uncover new insights, identify emerging themes or patterns, and generate hypotheses that can inform further research or theory development. This approach is useful when little is known about a topic, when researchers aim to explore diverse perspectives, or when investigating complex social phenomena where quantitative methods may not capture the depth of human experiences (Makri & Neely, 2021).

Although there are various sub themes in the qualitative research, the approaches are not mutually exclusive, and researchers often combine elements from different approaches within a single study. The choice of qualitative approach depends on the research question, theoretical framework, desired level of depth, and resources available. Each approach has its own strengths and limitations, and careful consideration is required to ensure rigor and trustworthiness in the study.

However, qualitative research faces challenges. Concerns over generalizability arise as findings are rooted in specific contexts and experiences. Critics argue that findings may not represent broader populations, requiring careful consideration of the research context and participant selection (Dawadi, Shrestha & Giri, 2021; Levitt, 2021; Smith, Flowers, & Larkin, 2009). Additionally, the subjective nature of data collection and analysis necessitates rigorous reflexivity. Researchers must acknowledge their own biases and positionality to ensure their interpretations remain grounded in the data and ethical considerations are maintained (Rios & Patel, 2023).

Despite these challenges, qualitative research offers invaluable insights into the subjective dimensions of human experience and social phenomena. By engaging with participants' emotions, narratives, and interactions, it unveils complexities often overlooked by quantitative approaches. Recognizing its strengths and limitations empowers researchers to conduct rigorous and meaningful qualitative studies, contributing to a richer and more nuanced understanding of the world we inhabit. This case study employs a qualitative research approach to gain a nuanced understanding of educators' and school leaders' experiences with pedagogical ICT integration within their natural school environment. Unlike quantitative methods, which focus on numbers and measurements, qualitative research allowed the researcher to delve into the richness of lived

experiences, contextual factors, and the interplay between participants and their surroundings. These aspects were crucial for understanding how educators and school leaders implement ICT integration in practice. Through in-depth interviews and observations, their perspectives were captured, challenges and opportunities they face were explored, and how the school environment shaped their approaches was examined. This rich data was then analyzed to identify themes and patterns, that led to a comprehensive portrayal of the phenomenon under investigation.

3.3 Research design

This section delves into the strategic framework guiding this study, meticulously outlining the empirical approaches employed to answer the central research question: What are the key opportunities that can transform the implementation of ICT pedagogical integration in South African schools?

Beyond technical directives, research methodology embodies a philosophical foundation, shaping our engagement with the world we explore (Mays & Pope, 2020). It serves as the compass guiding inquiry towards knowledge and understanding, ensuring the rigor and credibility of findings (Patton, 2020; Creswell & Creswell, 2017). By fostering transparency and replicability, it empowers critical evaluation and potential expansion upon research endeavours (Yin, 2015). Moreover, a well-conceived methodology safeguards participants' rights and ensures ethical responsibility (Sharma, Menard & Mutchler, 2019). This mastery equips us not only to conduct impactful research but also to critically evaluate existing knowledge across diverse fields, acting as a universal language for collaboration (Oliver, 2023; McGregor, 2017).

Several pivotal aspects crucial for conducting robust research is dealt with in this chapter. It begins by examining philosophical paradigms, delving into the core assumptions and implications of positivism, interpretivism, and critical theory within the context of our research framework. Following this, various methodological approaches are explored, encompassing quantitative, qualitative, and mixed methods techniques such as surveys, interviews, experiments, and content analysis. Each method is scrutinized for its strengths, weaknesses, and suitability for our specific research inquiry. Additionally, critical considerations are discussed, encompassing sampling strategies, data collection methods, analytical techniques, ethical considerations, and measures to ensure the rigor and trustworthiness of research findings. Furthermore, the section investigates contemporary trends and emerging methodologies, shedding light on how technological advancements and societal shifts shape the evolving research landscape. Ultimately, our goal is to equip readers with the necessary tools to navigate the complexities of the research journey effectively and to foster a discerning approach to consuming and interpreting research findings.

The case study approach was judiciously chosen for its ability to offer a contextualized and in-depth understanding of ICT integration within the complexities of South African public schools. This immersion into real-world experiences (Yin, 2015) allows for a comprehensive exploration of the factors influencing successful implementation. Purposive sampling strategically selected three South African public schools representing diverse ICT integration experiences (Creswell & Creswell, 2017). This approach ensured a broader understanding by capturing a range of perspectives and challenges (Patton, 2020). Data collection utilized a multifaceted approach to gather rich and comprehensive information. Semi-structured interviews with key stakeholders (principals, educators, ICT coordinators) served as the primary means, providing valuable insights into their experiences, perceptions, and challenges (Merriam & Tisdell, 2016). Additionally, classroom observations offered firsthand perspectives on the practical implementation of ICTs in teaching and learning (Emerson, Fretz, & Shaw, 2011).

3.3.1 Case study

The research approach adopted in this study facilitated the construction of a theory rooted in the data collected from the contextual setting, prioritizing inquiries into the "how" and "why" aspects rather than the conventional "when," "how much," or "extent" dimensions. In this pursuit, a case-study approach, as defined by Bromley (1986) as an in-depth and comprehensive investigation of specific cases, was deemed fitting. Alam (2023) & Yin (1994) emphasizes that a case study should unfold within a real-life context, aligning seamlessly with the study's focus on schools as the primary unit of analysis. This methodology offered a systematic and precise avenue to craft an enriched narrative of the phenomenon under examination, capturing the nuanced experiences of participants in schools through interviews and general observation to discern the intricacies of ICT integration implementation.

This case study was chosen for its contextual relevance, with the school serving as the locus of investigation (Stake, 1995). Importantly, the researcher wielded no control over ICT implementation at the school level, rendering the case study approach apt (Alam, 2021; Yin, 1994). The research, specifically framed as a phenomenological case study following McMillan and Schumacher's (2010) description, delved into the "lived experiences" of educators. By exploring educators' expressions of their experiences with ICTs and identifying the influencing factors in their pedagogical ICT integration, the study employed an exploratory and descriptive approach (Priya, 2021; Greene, 1997).

Participants hailed from four public primary schools in Gauteng, and the case-study design was instrumental in unraveling the complex relationships, contextual factors, and patterns characterizing educators' responses to pedagogical ICT integration. The data-rich process

acknowledged the variability among educators in their approaches to ICT implementation, necessitating a careful consideration of specific school context factors. While the unit of observation focused on educators and members of the management team (principals or deputy principals), the four case studies collectively offered comprehensive descriptions and interpretations of the intricate interactions among the school, management, and educators. This meticulous approach ensured a nuanced exploration of the multifaceted dynamics influencing pedagogical ICT integration within the educational context.

A single limitation inherent to case studies is the challenge of generalizing findings to a broader population (Yin, 1994). The results may not be directly applicable to all South African schools. However, the in-depth understanding gained from this specific case study can inform future research and potentially contribute to the development of a broader theoretical framework.

3.4 Research paradigm

The pursuit of knowledge in any academic domain is intricately intertwined with the guiding principles established by research paradigms. These overarching frameworks, encompassing ontological suppositions, epistemological convictions, and methodological approaches, form the bedrock upon which researchers construct their perspectives and methodologies (Creswell & Creswell, 2017). Delving into these paradigms is paramount, as they not only shape the inquiries researchers undertake but also direct the methodologies they employ in their pursuit of answers. At the heart of each paradigm lies its ontology, elucidating the fundamental understanding of reality it espouses. For instance, positivism asserts the existence of a fixed, objective reality accessible through standardized observation and measurement, while constructivism embraces a subjective reality molded by individual interpretations and experiences (MacLeod, Burm & Mann, 2022; Creswell & Creswell, 2017). These ontological divergences inherently inform the respective epistemological stances: positivist researchers seek universal truths through quantitative methods, while constructivists favor qualitative approaches that delve into individual experiences and sense-making processes (Bryman & Bell, 2015; Treacy, 2022).

As Denzin (2009) and Guba & Lincoln (1994) aptly describe, a paradigm can be understood as a "worldview" encompassing a set of beliefs and assumptions within a research community. This worldview serves as a guiding compass for researchers, steering them along philosophical assumptions related to ontological, epistemological, and methodological concerns. The selection of a paradigm has profound implications, shaping the research process and influencing the interpretation of findings. Different paradigms reflect contrasting ontologies – distinct perspectives on the nature of reality and what is being questioned. Epistemologies, on the other hand, delve into the realm of acceptable knowledge, exploring how answers to our research

questions can be ascertained. Methodology, the final piece of the puzzle, dictates the acceptable methods and procedures employed to make the inquiry possible.

Understanding these paradigms transcends mere scholarly discourse; it represents a pivotal stride towards fostering critical inquiry. By discerning the embedded assumptions within each paradigm, researchers can make informed choices regarding their methodologies and interpretations, thereby fostering reflexivity and acknowledging their own biases and positionalities within the research process (Creswell & Creswell, 2017). Ultimately, research paradigms serve as guiding beacons in the pursuit of knowledge, illuminating how researchers engage with the world and construct meaning. This profound understanding empowers researchers to critically engage with findings, pose insightful questions, and contribute to a nuanced comprehension of the world around us. Among the diverse paradigmatic perspectives in the research landscape, positivism, realism, pragmatism, postmodernism and interpretivism stand out as prominent approaches. The figure 3 gives an overview of research paradigms in a study.

Figure 3 Nature of research inquiry (adapted from Hitchcock and Hughes,1995)

3.4.1 Ontology

At the heart of every research journey lies ontology, the cornerstone upon which paradigms rest and inquiries unfold. It delves into the profound question of "what is?", shaping the very essence of reality researchers attempt to grasp. Within the realm of research paradigms, distinct ontological perspectives delineate diverse approaches to understanding reality. Objectivist ontologies, such as Positivism, assert the existence of an objective, external reality independent of human interpretation, emphasizing standardized observation and measurement as means of knowledge acquisition (Bibi, Khan & Shabir, 2022; Al-Ababneh, 2020; Hitchcock & Hughes, 1995). Critical Realism, on the other hand, acknowledges the existence of both an independent

reality and socially constructed meaning-making processes, delving into how societal structures influence the construction of knowledge (Lawani, 2021) . Subjectivist ontologies, exemplified by Constructivism, contend that reality is constructed through individual experiences and interpretations, favouring qualitative research methods to elucidate subjective realities (Bibi et al., 2022). Phenomenology, within this paradigm, directs attention to the lived experience and subjective meaning-making processes of individuals (Urcia, 2021). Relational ontologies, typified by Social Constructionism, posit that reality is socially constructed through interaction and discourse, highlighting the inherently social nature of knowledge production shaped by power dynamics (Trownsell, 2022). However, Tesar, Gibbons, Arndt, and Hood (2021) present a compelling critique that challenges the conventional conceptualization of reality. Within the framework of postmodernism, they assert the existence of multiple realities that are neither fixed nor singular, but rather contingent upon various factors such as language, discourse, and power dynamics. This perspective contests the notion of universal truths, emphasizing instead the context-specific nature of reality. Additionally, processual ontologies, exemplified by Process Philosophy, conceive reality as a continuous process of becoming rather than a static state, emphasizing change, dynamism, and interconnectedness (Stenner, 2022; Benett, 2020). Moreover, philosophical orientations such as Idealism propose that reality primarily resides within the realm of the mental or spiritual, relegating the physical world to a secondary status (Foster, 2021; Moravec, 2021). Notably, Dewey (1998) as cited in Hildebrand (2022) delineates pragmatism's stance on reality, defining it in terms of practical efficacy, thus prioritizing tangible consequences over abstract theories. Additionally, Healey (2020) elucidates the concept of Quantum Realism, which delves into the implications of quantum mechanics on our comprehension of reality, thereby challenging traditional conceptions of space, time, and causality. These ontological perspectives offer rich insights into the diverse ways in which researchers conceptualize and engage with reality within the research landscape.

Within this philosophical space, three distinct beliefs about reality emerge, each influencing the direction and interpretation of research endeavors. Firstly, the belief in a single reality or truth finds its manifestation in positivism. This paradigm posits an objective, external reality independent of human interpretation, accessible through standardized observation and measurement (Hildebrand, 2022). Quantitative research methods reign supreme here, seeking to uncover universal truths through statistically generalizable data (Bryman & Bell, 2015). Secondly, the belief in multiple realities or truths finds its voice in constructivism (Pilarska, 2021). Here, reality is constructed through individual experiences and interpretations, making each perspective unique and valuable (Creswell & Creswell, 2017). Qualitative methodologies take center stage, prioritizing lived experiences and subjective meanings to paint a multifaceted picture of reality (Treacy, 2022). Thirdly, the belief that reality as constantly changing and open to debate finds its

home in postmodernism (Javanmardi, Liu & Xie, 2020). This paradigm challenges the notion of singular truths, instead embracing multiple, contingent realities shaped by language, power dynamics, and historical contexts (Denzin & Lincoln, 2023). Critical reflection and reflexivity become crucial tools, as researchers acknowledge their own positions and biases within the research process.

These contrasting ontological stances highlight the dynamic nature of research paradigms. By recognizing how each belief system shapes questions asked, methods chosen, and results interpreted, researchers gain a deeper understanding of the knowledge they produce. Embracing this diversity fosters critical thinking, allowing researchers to navigate the intricate landscape of research with greater clarity and rigor. Ultimately, acknowledging the spectrum of ontological beliefs empowers researchers to contribute to a more nuanced and multifaceted understanding of our complex world.

3.4.2 Epistemology

At the heart of every scholarly pursuit lies the fundamental question of **epistemology**: how do we know what we know? This intricate branch of philosophy delves into the very nature of knowledge, examining the methods and processes through which we construct meaning and understand the world around us. By interrogating how we acquire knowledge, interpret reality, and engage with our own thinking processes, epistemology empowers researchers to navigate the labyrinth of information and critically evaluate the claims presented.

Three distinct stances on knowledge acquisition emerge within the diverse landscape of epistemology. Empiricism, championing the belief that knowledge can be measured using reliable designs and tools, emphasizes objective observation and experimentation as the primary avenues to truth (Sol & Heng, 2022). This approach aligns with quantitative research methods, where standardized data collection and meticulous analysis strive to uncover universal truths and verifiable knowledge (Bryman & Bell, 2015). In contrast, interpretivism posits that knowledge is inherently subjective and intertwined with individual values and experiences. Here, knowledge becomes a process of interpretation, requiring researchers to delve into the meaning behind phenomena and understand the unique perspectives of others (Smith, 2020). Qualitative methodologies, with their emphasis on lived experiences and subjective meanings, become crucial tools in this pursuit (Treacy, 2022). Finally, pragmatism rejects the rigidity of both empiricism and interpretivism, instead advocating for a flexible approach that utilizes whatever tools prove most effective in solving the problem at hand (Brambila, 2020; Rorty, 1991). This stance acknowledges the context-dependent nature of knowledge and encourages researchers to draw upon diverse methods and perspectives to achieve their goals.

Understanding these epistemological stances empowers researchers to make informed choices about their research practices. Empiricism lends itself to inquiries seeking generalizable findings, while interpretivism shines when understanding individual experiences and subjective meanings. Pragmatism fosters flexibility and creativity in research design, allowing researchers to adapt their methods based on the specific needs of their inquiry.

Ultimately, navigating the diverse landscape of epistemology is not about choosing a single "correct" approach, but rather about gaining a nuanced understanding of different perspectives on knowledge acquisition (Barzilai & Chinn, 2020). By critically examining their own assumptions and the assumptions embedded within various research approaches, researchers can engage in more rigorous and meaningful scholarly pursuits, ultimately contributing to a richer tapestry of human understanding.

i. Positivism

Positivism, a prominent research paradigm, stands upon the cornerstone of objectivity, privileging what can be directly observed and measured (Melnikovas, 2018). This philosophy aligns with an objectivist ontology, positing a fixed, external reality independent of human interpretation Dewey (1998 as cited in Hildebrand, 2022). Researchers adhering to this paradigm embrace quantitative methods, employing standardized observation and meticulous analysis to uncover generalizable truths about this objective reality (Bryman & Bell, 2015).

The strength of positivism lies in its emphasis on measurability, patterning, and predictability. By employing laws and rules to understand behavior and establish causal relationships (Cohen et al., 2011), positivist research allows for clear observation and quantifiable outcomes (Mohajan, 2020). As March and Storey (2008) highlight, this objective approach empowers researchers to predict and generalize the course of phenomena. However, positivism faces criticism for its potential disregard of individuality and social context. By prioritizing the objective and quantifiable, it might overlook the subjective experiences and interpretations that shape human behavior (Creswell et al., 2017). Additionally, the limited role of the researcher in data collection and interpretation, as described by Jamieson et al. (2023) and Collins & Cooper (2014), raises concerns about potential biases and a lack of reflexivity in the research process.

Despite these limitations, positivism remains a valuable tool for research seeking generalizable findings based on observable and measurable data. Recognizing its strengths and limitations equips researchers to make informed choices about when and how to utilize this paradigm, ultimately contributing to a richer and more nuanced understanding of the world around us.

ii. Pragmatism

This perspective is distinct from both positivism and interpretivism, offers a flexible and context-dependent approach to research (Lim, 2023; Tashakkori & Teddlie, 2021). Rejecting strict adherence to a single method or philosophy, pragmatism prioritizes practicality and the usefulness of research findings (Morgan, 2014b). This approach emphasizes selecting the best tools for the specific research question, regardless of their traditional paradigm affiliation (Creswell & Creswell, 2017).

One key implication of pragmatism is the blending of qualitative and quantitative methods, often referred to as mixed methods. This flexibility allows researchers to triangulate findings and gain a more comprehensive understanding of complex phenomena (Corrigan & Onwuegbuzie, 2020). For instance, a study exploring educator professional development might combine surveys to capture quantitative data on educators' experience and qualitative interviews to delve deeper into their individual perspectives and challenges. Furthermore, pragmatism emphasizes the importance of context and social justice. Recognizing that research occurs within specific historical, cultural, and political contexts, pragmatists strive to conduct research that is meaningful and impactful for the communities they study (Merriam, 2009). This often involves engaging stakeholders in the research process, ensuring findings are relevant and contribute to positive social change. However, pragmatism also faces challenges. Critics argue its flexibility can lead to a lack of theoretical grounding and difficulty in replicating findings (Greene, 2007). Additionally, the emphasis on context can make it challenging to generalize findings to other populations or settings.

Despite these limitations, pragmatism offers a valuable research paradigm by encouraging methodological creativity and prioritizing the usefulness of research for addressing real-world problems. By acknowledging the complexity of social phenomena and embracing context, pragmatist research contributes to a deeper understanding of the world and strives to make a positive impact.

iii. Realism

This approach is distinct from both positivism and interpretivism, as it offers a unique lens for understanding the world through exploring causal mechanisms that generate observable phenomena. The assertion diverges from the positivist tradition, which prioritizes the quantification of observable phenomena, and the interpretivist approach, which centers on individual subjective interpretations. Instead, it posits a stratified ontology, wherein observable phenomena act as portals to an underlying veritable realm (Pawson & Tilley, 1997, as cited in Jagosh, 2021).

Central to realism is the concept of causal mechanisms. These mechanisms, often hidden and complex, are believed to produce the outcomes we observe (Bhaskar, 2020). The goal of realist research is to identify and explain these mechanisms, thereby achieving a deeper understanding of how and why phenomena occur. Unlike positivist approaches seeking universal laws, realist researchers explore context-specific mechanisms that may operate differently in different circumstances (lawani, 2021). Realism employs a mixed methods approach. While acknowledging the subjective nature of human observations and interpretations, it recognizes the potential for triangulation and convergence through combining qualitative and quantitative methods (Pawson & Tilley, 1997, as cited in Jagosh, 2021). This blend allows researchers to capture both the richness of individual experiences and the broader patterns hidden beneath (Jackson, Mohr & Kindahl, 2021; Makumbang, 2023).

Realist research thrives on critical engagement with theory. Researchers actively draw upon existing theoretical frameworks while simultaneously critiquing and refining them based on empirical findings (Bhaskar, 2020). This iterative process contributes to a more nuanced understanding of how theories map onto the complex mechanisms generating social reality. However, realism faces several challenges. Critics like Earnshaw (2020) argue that identifying and isolating causal mechanisms in complex social systems can be difficult, leaving room for subjectivity and interpretation. Additionally, the emphasis on context-specificity can make it challenging to generalize findings beyond the specific study settings.

Despite these limitations, realism offers a valuable research approach for delving into the "why" behind observed phenomena. Its emphasis on causal mechanisms, mixed methods approach, and critical engagement with theory contribute to a richer understanding of the complex world we inhabit. By acknowledging its strengths and limitations, researchers can leverage realism to generate both insightful explanations and impactful interventions in diverse fields such as social policy, education, and healthcare.

iv. Postmodernism

Diverging from traditional research paradigms, postmodernism presents a critical and deconstructive perspective for exploring the world. It questions the idea of a single, objective reality, instead highlighting the fragmented and contingent nature of knowledge and meaning. This approach questions universal truths and instead foregrounds the subjectivity, power dynamics, and social constructions that shape understanding and experience (Denzin et al., 2023).

Central to postmodernism is the rejection of grand narratives and the embrace of multiplicity and plurality. Different social groups, cultures, and individuals are understood to possess unique and valid perspectives, challenging dominant narratives, and highlighting the limitations of any single

viewpoint (Smith, 2021). This emphasis on difference promotes reflexivity, as researchers acknowledge their own positionality and potential biases influencing their interpretations (Bukamal, 2022). Methodologically, postmodernism embraces non-traditional approaches. Qualitative methods such as autoethnography, narrative inquiry, and performance-based research gain prominence, allowing researchers to explore subjective experiences and challenge traditional categories of knowledge (Denzin et al., 2023). Additionally, postmodern researchers often engage in critical discourse analysis, deconstructing the language and rhetoric employed in various social and cultural domains to expose underlying power structures and ideologies (Fairclough, 2013). However, postmodernism faces criticism for its perceived relativism and lack of grounding in objective reality. Critics argue that the emphasis on multiple perspectives can make it difficult to draw any meaningful conclusions or make claims about the "truth" of any phenomenon (Hammersley & Atkinson, 2019). Additionally, its critiques of grand narratives can be seen as hindering efforts to address urgent social problems requiring broader theoretical frameworks.

Despite these criticisms, postmodernism offers a valuable research approach for challenging dominant narratives, exploring marginalized perspectives, and promoting reflexivity in research practices. By recognizing its strengths and limitations, researchers can leverage this approach to generate insightful analyses of complex social phenomena and contribute to a more inclusive and nuanced understanding of the world.

V. Interpretivism

For this research, which delves into the intricacies of ICT implementation through the lens of personal interactions and subjective interpretations, the paradigms were deemed unsuitable. The study's focus on understanding the lived experiences of participants through interviews necessitates an approach that values subjective meaning and contextual understanding. Interpretivism, distinct from positivist paradigms, presents a compelling lens for exploring social phenomena (Cresswell et al., 2017). Rooted in the belief that reality is socially constructed and subjective, it prioritizes individual experiences, meanings, and interpretations over objective observation (Lincoln & Guba, 1994). This emphasis on subjectivity necessitates an in-depth exploration of context and perspectives, challenging the positivist notion of universal truths.

Qualitative research methods, such as interviews, participant observation, and document analysis, become the prime tools for interpretivist researchers (Bryman & Bell, 2015). This study adopts the interpretivist approach because these methods delve into the subjective realities and meanings ascribed to phenomena by individuals within their specific social contexts. Embracing interpretivism requires acknowledging the inherent subjectivity of human experience and recognizing the powerful influence of language, culture, and social interactions on individual

understandings (Creswell et al., 2017). Because interpretivism emphasizes the socially constructed nature of reality, reflexivity emerges as a cornerstone of this paradigm, prompting researchers to critically examine their own biases and positionalities throughout the research process (Weatherford, 2019). This self-awareness fosters transparency and rigor, ensuring interpretations are grounded in careful consideration of multiple perspectives. Ultimately, interpretivist research offers a nuanced approach to understanding the complexities of human behavior, social interactions, and cultural phenomena. By adopting an interpretivist lens, we can recognize the multifaceted nature of the social world and embrace the subjective experiences that shape it, contributing to a richer and more comprehensive understanding of human existence.

Implications for using interpretive approach for ICT pedagogical ICT integration

Utilizing interpretivism as a research paradigm in the context of pedagogical integration of ICTs in schools carries significant implications. Interpretivism, grounded in the understanding that reality is socially constructed and subjective, offers a lens through which to explore the complex and multifaceted nature of ICT integration in educational settings (Mulisa, 2022). By embracing interpretivism, researchers acknowledge the diverse perspectives, experiences, and meanings attributed to ICT use by various stakeholders within the school community, including educators, learners, administrators, and parents.

One implication of adopting interpretivism is the recognition of the importance of understanding the contextual factors that influence the pedagogical integration of ICTs. Interpretivist research emphasizes the exploration of the social, cultural, and institutional dynamics that shape educators' beliefs, attitudes, and practices regarding ICT use in teaching and learning (Abel, Tondeur & Sang, 2022). This approach allows researchers to delve into the nuances of school cultures, policies, and practices, shedding light on the complex interplay of factors that either facilitate or hinder effective ICT integration.

Moreover, interpretivism emphasizes the importance of qualitative research methods such as interviews, observations, and document analysis. These methods enable researchers to capture the rich, nuanced narratives of educators and other stakeholders regarding their experiences with ICT integration. By engaging in qualitative inquiry, researchers can uncover the underlying meanings, interpretations, and rationales behind educators' pedagogical decisions and practices related to ICT use. Furthermore, interpretivism encourages reflexivity and acknowledges the role of the researcher's subjectivity in shaping the research process and interpretations. Researchers employing interpretivist approaches must critically reflect on their own biases, assumptions, and values, recognizing how these factors may influence the research findings. This reflexivity

enhances the rigor and validity of the research by promoting transparency and self-awareness throughout the research process.

In relation to pedagogical integration of ICTs in schools, interpretivism offers insights into the diverse ways in which educators conceptualize, adopt, and adapt ICTs in their instructional practices (Abedi, 2023). By understanding the subjective perspectives and lived experiences of educators, researchers can identify the challenges, barriers, and opportunities associated with ICT integration, thereby informing the development of contextually relevant strategies and interventions to support educators in effectively integrating ICTs into their teaching practice.

Overall, employing interpretivism as a research paradigm in the study of pedagogical integration of ICTs in schools facilitates a deeper understanding of the complex socio-cultural dynamics at play and provides valuable insights for enhancing ICT integration efforts to promote meaningful and impactful teaching and learning experiences.

Rationale for adopting interpretive approach

Critical theory offers valuable insights into the construction of social knowledge, shedding light on the power dynamics, inequalities, and social structures that shape individuals' realities. In the realm of interpretive research, the focus lies on comprehending the diverse realities experienced by individuals within various contexts. The interpretive paradigm, as Cohen et al. (2018) eloquently describe, aligns perfectly with these research objectives. It seeks to comprehend the subjective realm of human experience, preserving the integrity of the phenomena under investigation. By striving to understand the context of a situation from within an individual's perspective, the interpretive paradigm honors the nuances and complexities of human experience. Given the emphasis on social interactions and the interpretation of meaning within the context of schools, the research involves educators within their educational milieu, exploring their strategies for implementing pedagogical integration of ICTs in the classroom through collaborative inquiry. This approach fosters a collective process of constructing shared meanings and determining actionable steps. Through an interpretive lens, researchers navigate diverse situations and contexts, conducting inquiries in natural real-world settings to elucidate the interpretation and meanings of phenomena (Denzin & Lincoln, 2009). Interpretivism values multiple data-collection methods, particularly interviews and participant observation, allowing for a comprehensive exploration of perspectives. This study investigates how educators integrate ICT into their teaching practices, employing an interpretive approach due to its practicality and context-driven nature. Moreover, the interpretive paradigm offers a fitting framework for this research. Collis and van der Wende's (2002) theoretical framework align seamlessly with the interpretive paradigm, as it acknowledges the context-related factors influencing the pedagogical integration of ICTs. This

alignment ensures that the theoretical framework guides the formulation of pertinent interview questions, facilitating a deeper exploration of ICT integration practices in participants' work environments. Social constructivism, akin to interpretivism, delves into the factors shaping ICT integration within each school's specific context. It recognizes participants' backgrounds and their influence on interpretations of ICT integration experiences (Creswell & Poth, 2016). By interpreting participants' construction of meaning, the researcher constructs a representation of reality consistent with the epistemological assumptions of the interpretive paradigm (Creswell & Poth, 2016). The interpretivist methodology enables the collection of qualitative data through interviews and participant observation, fostering a profound understanding of the intricate realities of pedagogical ICT integration in education.

As educators navigate challenges in ICT integration, the interpretive paradigm offers a theoretical and practical framework for comprehending the transformative potential of ICT pedagogical integration in education. In an era marked by technological advancement, proficient ICT utilization in teaching and learning is imperative for educators, ensuring their preparedness to meet the demands of the 21st-century economy and workforce. In conclusion, the interpretive paradigm, with its focus on subjective meaning and contextual comprehension, provides an apt framework for this research. By embracing the interpretive perspective, the researcher can delve into the nuances of ICT implementation from participants' perspectives, fostering a deeper understanding of the factors influencing successful ICT integration in South African public schools.

3.5 Research approach

In the tapestry of research approaches, two distinct threads stand out: inductive and deductive reasoning Saunders et al. (2016). Like opposing forces yet complementary partners, each offers a unique lens for exploring the world. The inductive approach**,** akin to an explorer forging a path through uncharted territory, delves into data-rich landscapes, meticulously collecting observations and allowing patterns to emerge. This bottom-up journey generates novel insights and reveals previously unseen connections. Conversely, the deductive approach, resembling a skilled detective wielding a well-honed theory, descends from established knowledge like a hawk circling its prey. Hypotheses are tested, refined, and confirmed or refuted, solidifying existing understanding. Within this research landscape, understanding the strengths and limitations of both approaches, inductive capacity for discovery and deductive power for confirmation, equips researchers to skillfully navigate the path towards knowledge creation. This section delves into these contrasting yet intertwined research approaches, highlighting their distinct contributions to enriching our understanding of the world around us.

3.5.1 Deductive approach

The deductive approach in research involves the formulation of hypotheses or theories based on existing knowledge or literature, which are then evaluated through empirical observation and data analysis (Bryman & Bell, 2015). This methodological framework begins with a clear and specific research question, derived from established theories or conceptual frameworks, guiding the subsequent data collection and analysis process (Azungah, 2018). Deductive reasoning moves from general principles to specific observations, aiming to confirm or refute pre-existing theoretical assumptions. By employing deductive reasoning, researchers can systematically evaluate the validity of hypotheses or theories, thereby contributing to the advancement of knowledge within their respective fields (Okoli, 2023). Moreover, the deductive approach often involves quantitative data collection methods, such as surveys or experiments, allowing for the rigorous testing of hypotheses and the generalization of findings to broader populations (Patton, 2020). However, while deductive reasoning offers a structured and systematic approach to research, it also has limitations. One challenge lies in the potential for confirmation bias, wherein researchers may selectively interpret data to align with their preconceived hypotheses (Guba & Lincoln, 1994). Additionally, deductive research may overlook novel or unexpected findings that do not fit within existing theoretical frameworks. Nonetheless, when employed judiciously and in conjunction with other research paradigms, the deductive approach remains a valuable tool for generating empirical evidence and advancing scientific knowledge.

3.5.2 Inductive approach

Diverging from deductive reasoning, the inductive approach offers a methodology that starts from specific observations or data, gathered through qualitative or quantitative methods, to uncover patterns, themes, and potential explanations embedded within them (Azungah, 2018). Unlike deductive reasoning, which begins with established theories and tests hypotheses, the inductive approach allows researchers to explore uncharted territory, facilitating discovery and the generation of new knowledge (Blaikie & Priest, 2022). The deductive approach employs existing literature to categorize theories and concepts, which the researcher subsequently utilizes for data assessment. In contrast, the inductive approach commences with data collection, culminating in the development of theory derived from the results of data analysis. McMillan and Schumacher (2010) elucidate that inductive analysis involves the synthesis and interpretation of data, initiating with specific data points and concluding with the identification of overarching themes or patterns.

The impact of the inductive approach on research is multifaceted. One key advantage lies in its capacity to unveil previously unknown phenomena or relationships (Bryman & Bell, 2015). By permitting patterns to emerge organically from the data, it fosters rich and detailed findings that might have been overlooked by predetermined theoretical frameworks. Furthermore, the inductive

approach promotes flexibility and adaptation during the research process. As new insights surface, researchers can refine their focus and data collection strategies, ultimately leading to a more grounded and nuanced understanding of the phenomenon under investigation (Denzin & Lincoln, 2023). Nevertheless, the inductive approach also poses certain implications for study design and analysis. While it excels in generating new knowledge, establishing theoretical rigor can be challenging. Researchers must navigate the balance between immersing themselves in the data and ensuring their interpretations remain logically sound and evidence-supported (Guba & Lincoln, 1994). Additionally, the inductive approach often requires larger and more comprehensive datasets to facilitate robust pattern identification and the generalization of findings (Patton, 2020).

Despite these challenges, the advantages of the inductive approach for research are undeniable. Its capability to uncover the unexpected, foster flexibility, and contribute to a richer understanding of the world makes it a valuable tool across diverse disciplines. By acknowledging both its strengths and limitations, researchers can strategically employ the inductive approach to generate novel insights and contribute to the evolving landscape of knowledge.

In alignment with the nature of this study, which involves a comprehensive consideration of educators' and principals' perspectives along with the researcher's reflective insights rooted in the contextual backdrop and existing literature, the inductive approach was adopted. The data provided by participants was meticulously scrutinized and analyzed to elucidate recurring themes, which in turn were employed to address the research question. This methodological approach fosters the identification of thematic patterns within the data, thereby serving as instrumental aids in shaping the researcher's construction of a robust narrative grounded in empirical evidence. The inductive paradigm, therefore, proved instrumental in capturing the nuanced complexities within the data and providing a robust foundation for the study's theoretical framework.

3.6 Data collection

Blanche et al. (2009) delineate sampling as the meticulous process of selecting research participants from a broader population, involving decisions about which groups, settings, procedures, or processes to observe. In the qualitative context of this study, the representativeness of the number of schools selected was not a primary concern due to the depth-oriented nature of the research, where sample size was deemed inconsequential.

The chosen sample of schools aimed to typify others in South Africa facing similar challenges in the implementation of pedagogical ICT integration. Conducted in Gauteng, the study represented other provinces due to the proximity of the data collection sites. While McMillan and Schumacher (2010) caution against small, unrepresentative samples, they underscore the importance of

reflecting the relevant population characteristics in the study. In this light, the selected schools mirrored those falling within contextual categories concerning pedagogical ICT integration, validating the study's generalizability. To attain in-depth knowledge, the study considered educators' positions, their interaction with policy, and factors impacting ICT implementation, making a large sample impractical. Therefore, the research focused on four public primary schools, providing sufficient diversity without compromising depth. Geographically limited to Gauteng's District 9 in Johannesburg East, practical constraints and the researcher's role as an educator necessitated purposive convenience sampling.

Stake (2000) and Merriam (2009) advocate for purposive sampling, emphasizing its utility in facilitating intense, in-depth studies. Purposefully chosen, the four schools comprised two ex-Model C schools (one on the ICT project, the other not) and two township schools (similarly, one on the ICT project, the other not). This demographic diversity aimed to capture a spectrum of responses to ICT integration, offering insights into facilitators and barriers applicable to all schools. The researcher's employment at one of the schools in the sample justified purposive convenience sampling. Although this method poses limitations, such as limited generalizability, the study prioritized context-specific insights. While convenience sampling may lack broader representativeness, the familiarity with staff aimed to elicit more transparent participant responses, enhancing the authenticity of the results. The study acknowledged its limited scope and refrained from unwarranted generalizations, focusing on deriving valuable insights from the selected schools' specific contexts.

3.6.1 Participants

In adhering to a meticulous participant selection process, specific criteria were established to ensure a comprehensive representation of educators and school management across the selected schools. The criteria aimed at encompassing different educational phases (Foundation, Intermediate, Senior) and roles within each school, thereby providing a holistic understanding of the dynamics influencing the implementation of ICT integration. For educators, the selection process targeted at least one representative from each educational phase in every school, along with a member from the School Management Team (SMT). This equated to a total of (at least) three educators and one manager from each of the four schools, resulting in a cohort of 16 participants. The participants were chosen based on their active engagement with ICT tools for various purposes, whether administrative or instructional.

The rationale behind including SMT members, particularly the Principal or Deputy Principal, was to incorporate a managerial perspective into the study. This strategic choice aimed at unraveling the intricacies of school dynamics and understanding the leadership's role in shaping the contours

of ICT integration. The sample size of 12 educators and 4 SMT members was considered adequate for discerning general trends, offering a nuanced background understanding of the varied influences and challenges related to the pedagogical integration of ICTs at schools. To initiate the participant selection process, direct engagement with school management was prioritized. Principals or Deputy Principals were initially approached to apprise them of the study and its objectives. Subsequently, the researcher sought referral to the ICT coordinator, or an educator recognized as an ICT champion within the school. The ICT champion educator played a pivotal role, not only as a direct participant but also as a conduit to recommend educators from other phases. The researcher devoted significant time to engaging with the ICT champion educator, garnering an in-depth and overarching response to the prevailing trends within the school and their specific educational phase. Subsequent interviews cascaded from lower to upper levels, starting with the ICT champion educator, followed by educators from each phase, and culminating with a managerial interview with the Principal or Deputy Principal. This sequential approach ensured a comprehensive exploration of insights across different levels of school hierarchy, enriching the depth and diversity of the study.

3.6.2 Semi-structured interviews

The main source of data collection in this study was semi-structured interviews on a one-on one basis. This interview method allowed the researcher to prompt the educator being interviewed to elaborate on the data being shared, the participants own individual experiences and opinions about implementing the pedagogical integration of ICTs were voiced and since the data was collected in the absence of other educators or superiors, it allowed the participants to give honest answers rather than those that they believed to reflect the politics of the school.

The semi structured questions allowed for flexibility in asking questions and lead questions. Appendix E details the interview schedule utilized during the data collection process. An interview using several open-ended questions gave the respondent a chance to prioritise the salient features of the topic at hand and therefore lead into discourse about the far-reaching implications of these. A well-conducted interview allowed for probing nuances of the implementation of ICT integration in teaching and learning which was vital in understanding the topic in general. The participants were interviewed to specifically find out about their personal responses to the implementation of the pedagogical integration of ICTs and what factors influences their practices. Some of the questions considered a close inspection of the participants understanding of the ICT policy. Probing questions were necessary to find out how the participants understand, interpret, and implement the ICT policy in education. To this end, an interview protocol was developed. The purpose of each interview was to obtain accurate data relevant to the individual participant's opinions and experience. From the trends drawn from sixteen of these interview protocols, a small sample of opinions and experiences were collated to generate sub themes of' responses from the

participants. The interviews that took place were both face to face and virtual, based on the context of the school and preferences of the participants. These were recorded using an audio recording application. The interview technique was interpretive as supported by Blanche et al. (2009) since it was used to make sense of the participants' experiences and practices by interacting with them.

3.6.3 Document analysis

Bowen (2009) describes document analysis as a form of qualitative research whereby documents are interpreted by the researcher to give voice, add value, and gives meaning to the topic. Stake (1995) and Yin (1994) augment that document analysis involves an intense study by producing a rich description of a single phenomenon, event, organization, or program. Merriam (1998) highlights that documents can assist in a study to make meaning and add value. The ICT policy in education (White paper on E-education, 2004); Curriculum policies & Strategies for ICT integration frameworks were analyzed by the researcher to identify the relevant themes pertaining to the pedagogical Integration of ICTs. The applicable points were used against the data collected from the interviews to determine whether the pedagogical integration of ICTs is implemented equitably between schools.

3.7 Data analysis

Triangulation is a technique used in qualitative research to assist the researcher to gain a richer understanding of the topic. It involves incorporating multiple sources of information or methods. This includes using a combination of data collection methods like interviews and observations or employing different research methods such as surveys and focus groups (Vivek, 2023). Triangulation strengthens the research by offering a more comprehensive perspective. There are four main types: method triangulation utilizes various research methods, investigator triangulation involves multiple researchers analyzing the data, theory triangulation examines the data through different theoretical frameworks, and data source triangulation gathers information from diverse sources such as participants and documents (Sciberras & Dingli, 2023). By utilizing these approaches, researchers can build a more robust and well-rounded understanding of the phenomenon they are investigating.

This research employed a form of data source triangulation to gain a more comprehensive understanding of the phenomenon under investigation. Triangulation refers to the use of multiple data sources in qualitative research. In this study, data collected from two distinct sources: managers and educators. Each group played a crucial role in the implementation of pedagogical ICT integration and possessed unique perspectives on its impact and challenges. By interviewing both managers and educators, a richer picture that encompasses the experiences and viewpoints of

those who formulate policy (managers) was captured and those who implement it on the ground (educators). Furthermore, the use of differentiated interview tools strengthened this approach. Tailoring interview questions to each group allowed the researcher to delve deeper into the specific knowledge and lived experiences. Managers were asked about strategic goals and resource allocation, while educators were asked about classroom practices and learner engagement. This targeted approach ensured that the data collected is highly relevant to each group's perspective. Ensuring the robustness and reliability of the research presentation demanded a meticulous approach, with the ICT policy serving as a foundational element further assisted in triangulating interview data from the two different perspectives to existing literature. This triangulation methodology, as advocated by Bowen (2009), provided a convergence of evidence, thereby enhancing the credibility of the study. Emphasizing the ongoing nature of analysis in qualitative research, McMillan, and Schumacher (2010) underscored its interwoven relationship with data collection. Consequently, the researcher conducted a continual review and analysis of responses both during and after the interview process. This iterative approach allowed for a dynamic interaction between data collection and analysis, shaping the evolving understanding of the subject matter.

The voluminous qualitative data generated through comprehensive semi-structured interviews necessitated a systematic and thorough analysis. Recordings of interviews were transcribed verbatim, laying the foundation for a meticulous examination of pertinent strands aligned with the research focus. This extensive process contributed significantly to capturing educators' nuanced experiences and opinions, facilitating the identification and classification of common themes that shed light on the factors influencing the implementation of ICT integration.

3.7.1 Thematic analysis

Thematic analysis, an integral component of qualitative research methodology, serves as a meticulous tool for unravelling recurring patterns of significance within textual data. Functioning akin to a deciphering mechanism, it penetrates the subjective dimensions of human experiences, elucidating both the "what" and "why" behind them (Braun & Clarke, 2006). This process entails an immersive journey through transcripts, interviews, or open-ended responses, akin to an archaeologist piecing together fragments to reveal hidden artifacts. Following a systematic six-phase approach outlined by Nowell et al. (2017), researchers engage in cycles of immersion, coding, theme generation, and refinement, weaving together thematic threads that encapsulate key concepts or understandings shared by participants.

This research embraced the Collis and van der Wende (2002) framework, originally designed for predicting ICT integration within Higher Educational Institutions (HEIs). The framework was

adapted to the South African school context, recognizing its potential to illuminate both similarities and divergences. Thematic analysis, a well-established qualitative research method, served as our primary analytical tool. This study employed Braun and Clarke's (2021) six-phase approach, encompassing:

1. **Data familiarization:** Immerse the researcher in the data (interviews, transcripts, etc.) to grasp its essence.
2. **Systematic coding:** Identify recurring patterns and assign codes to represent them.
3. **Generating initial themes:** Group related codes into potential themes.
4. **Developing and reviewing themes:** Refine, define, and name themes based on data support and theoretical relevance.
5. **Refining, defining, and naming themes:** Ensure clarity, coherence, and theoretical alignment.
6. **Writing the report:** Integrate theme analysis findings with the overall research narrative.

In this study, "Transforming Education through the implementation of ICT pedagogical integration in South African schools," the analytical framework was guided by the theoretical model proposed by Collis and van der Wende (2002), tailored to the context of South African schools. Thematic analysis, as delineated by Braun and Clarke (2006), provided the methodological backbone, encompassing phases such as data familiarization, systematic coding, theme generation, refinement, and report writing.

Data segmentation and coding were executed systematically, initially performed individually after each interview, and subsequently refined through collaborative efforts. This process involved the classification of data segments into major, minor, and important codes, leading to the organization and refinement of sub themes representing common themes or patterns. Throughout the analysis, themes were intricately interwoven with the theoretical framework, providing a lens through which to interpret findings and refine theoretical constructs within the South African educational landscape.

Key themes that emerged from the thematic analysis shed light on critical challenges and opportunities pertaining to ICT integration in South African schools. These encompassed issues such as infrastructure and access, educator training and support, curriculum alignment, leadership and vision, and learner agency and engagement. Braun & Clarke (2006) delineate two tiers of themes: semantic and latent. Semantic themes operate within the explicit or surface meanings of the data, where the analyst confines their exploration to what participants have directly articulated or written. The analysis presented in this exemplar identifies themes at the semantic level, a common practice in learning and teaching research. It transcends mere description by delving into

interpretation and explanation of the data. In contrast, latent themes venture beyond the explicit content, delving into the underlying ideas, assumptions, and conceptualizations - including ideologies - theorized to shape or inform the semantic content of the data.

Despite the robustness of thematic analysis, inherent subjectivity necessitates vigilant measures to mitigate researcher bias. Detailed audit trials, team discussions, and expert feedback were employed to ensure methodological rigor and trustworthiness of findings. Additionally, while the analysis of large datasets can be time-intensive, rigorous coding strategies facilitated comprehensive and reliable data interpretation. Thematic analysis proved indispensable in illuminating the multifaceted landscape of ICT integration in South African schools. By elucidating challenges and opportunities, this study offers valuable insights for policymakers, educators, and researchers, fostering evidence-based interventions that harness the transformative potential of ICT in advancing education within the South African context.

The resulting data sets underwent further classification based on major, minor, and important codes, leading to the organization and refinement of sub themes representing common themes or patterns. The analysis of these themes was intricately interwoven with the theoretical framework detailed earlier, providing a lens through which to interpret the findings. Instances where the collected data did not seamlessly align with the theoretical framework prompted adjustments, facilitating the continuous refinement of the study's theoretical underpinnings in the South African educational context. Furthermore, literature played a dual role in this analytical process: establishing the theoretical foundation and guiding the interpretation of factors influencing ICT integration. This multi-layered analytical approach ensured the depth, coherence, and theoretical alignment of the study, contributing to a nuanced understanding of the complexities inherent in the implementation of ICT integration in South African schools.

3.7.2 Coding

Coding is a fundamental process for uncovering patterns and themes within data sets. It involves categorizing and labeling qualitative data systematically, often in methodologies like thematic analysis or grounded theory (William & Moser, 2019). Researchers assign codes to segments of data, such as interviews or documents, based on shared ideas or themes. While existing theoretical frameworks or research questions might guide the code development, the codes themselves frequently emerge directly from the data itself. Different coding approaches include open coding, axial coding, and selective coding, each contributing to the organization and analysis of data. Coding not only helps manage large data sets but also reveals insights and interpretations. Analyzing coded data enables researchers to explore relationships and trends, contributing to theory development or refinement. Coding is an essential process for qualitative research,

allowing researchers to extract meaningful conclusions and uncover the hidden insights within their data.

3.8 Validity

The concept of "validity" holds various perspectives, as emphasized by Creswell and Miller in Summer (2000). Traditionally, the assessment of research quality and trustworthiness incorporates parameters such as reliability, validity, objectivity, and generalizability, as outlined by Hammersley (2000). However, the paradigm of qualitative research, as proposed by Lincoln and Guba (1986), introduces alternative constructs, namely credibility, dependability, confirmability, and transferability. In this study, validity was upheld through the meticulous collection and interpretation of data, drawing on the richness and depth inherent in the participants' personal accounts of their experiences. The research unfolded in an honest and objective manner, dedicated to uncovering the clearest insights within the scope of the study.

Triangulation emerged as a pivotal strategy employed to maximize validity. This approach involved aligning the research context with established theories, contributing to the robustness of both reliability and validity in the case study. The interview instruments were deliberately designed to correspond with each other, facilitating overlapping responses. This intentional design allowed for triangulation of responses, thereby enhancing the authenticity and credibility of the data. The strength of this case study's reliability and validity stems from the meticulous alignment of the research context with established theories, creating a symbiotic relationship between the study's unique setting and the broader tested frameworks. The deliberate design of interview instruments, allowing for overlapping responses and subsequent triangulation, further solidified the credibility of the findings. In essence, this methodological approach ensured a comprehensive and nuanced exploration of the research questions, contributing to the overall rigor of the study.

3.9 Ethical considerations

The meticulous consideration of ethical principles throughout the research process was paramount to safeguarding the rights and well-being of the study participants. In line with the cornerstone principles of ethical research, the current study adhered rigorously to protocols designed to minimize any potential harm or negative consequences for the participants. This rigorous adherence to ethical research protocols necessitated securing approval from the University's Human Research Ethics Committee (HREC). Subsequently, the researcher obtained the necessary ethics clearance, enabling the collection of data (refer to Appendix A). Furthermore, the appropriate Gauteng Department of Education (GDE) request form was duly submitted to GDE and has since been issued (refer to Appendix B), and with prior institutional consent, research

commenced at all four designated case study sites (Appendix C). Appendix D contains the informed consent form employed to acquire participant agreement for participation in the study.

Throughout the research endeavour, the utmost importance was placed on securing informed consent from all participants. This entailed explicitly informing the participants of their right to anonymity, the voluntary nature of their participation, and the option to withdraw from the study at any point should they feel discomfort or apprehension. This unwavering commitment to informed consent served to empower the participants and safeguard their autonomy throughout the research process. The ethical considerations extended beyond the protection of individual participants to encompass the preservation of confidentiality for the educators, principal, and schools involved. The participants were clearly informed about the nature of the study, the intended data analysis procedures, and the ultimate purpose of utilizing the collected data for academic publication. This fostering of transparency fostered trust and rapport between the researchers and the participants, further enhancing the study's ethical integrity.

Fortunately, the study witnessed full cooperation, with all participants successfully completing the interviews. The paramount consideration throughout the research process was the non-disclosure and confidentiality of educators, principals, and the respective schools. Participants were apprised of the study's nature, its analytical procedures, and the intended use of the collected data in the subsequent paper. This transparent communication ensured that participants had a clear understanding of the research objectives, contributing to an ethical and responsible research environment.

3.10 Conclusion

In conclusion, this study set out to address the critical inquiry: What are the key opportunities that can transform the implementation of ICT pedagogical integration in South African schools? Embracing a qualitative research approach underpinned by interpretivism, the study employed a case study methodology involving interviews with 16 participants. Purposive sampling method was employed to select research participants. Each primary school provided one educator from each phase (Foundation, Intermediate, and Senior), along with a school manager. In total, four schools were chosen to represent diverse demographic contexts: one ICT school and one non-ICT school from both townships and suburbs (resulting in four sampled schools). Successful acquisition of ethics clearance facilitated the conduct of interviews in these schools, ensuring adherence to rigorous ethical standards. Through this methodological framework, the study navigated the complex landscape of ICT integration in South African schools, offering valuable insights into the challenges and opportunities encountered in this transformative endeavor. The

findings of this study are anticipated to contribute to the enhancement of educational practices and policies aimed at fostering effective ICT integration in the South African educational context.

Chapter Four: Data presentation and results

4.1 Introduction

This chapter delves into the systematic procedures employed in data collection, data management, presentation of results, thereby providing a comprehensive overview of the study's findings. The study adopted a qualitative approach which explores the subjective experiences, meanings, and interpretations of individuals or groups on the phenomenon being studied. The primary objective of this research is to examine the implementation of ICT pedagogical integration at the school level, with a particular focus on South African public schools. Consequently, this chapter addresses three sub-questions derived from the main research question. (**Refer to section 1**) i.e.:

1. How did the one-size-fits-all approach to ICT integration affect the success of ICT implementation in selected ICT and non-ICT South African schools?
2. What are the potential drawbacks and limitations of the one-size-fits-all approach in the context of ICT implementation?
3. What framework can be effective for the transformation of ICT integration in education, drawing from the lessons learned from the sampled schools?

To gather data for this research, a qualitative data collection approach was employed. Semi-structured interviews were conducted with twelve (12) educators and four (4) managers from four public primary schools in Gauteng. The information gathered was aligned with the evolving context of the study, and key sub-themes were identified from the data. The outcomes of the interviews are discussed in detail in this chapter. The interviews are quoted verbatim to preserve the authenticity of the study and to respect the participants' responses. Table 2 presents a comprehensive overview of the pseudocodes used to hide the participants' identity, alongside detailed descriptions of participants' job titles, the types of schools represented, the grades taught, and the subjects covered. This table serves as a structured reference point elucidating the characteristics of the study participants, facilitating a clear understanding of their roles within the educational context.

Table 2: Occupational characteristics of the participants

Occupational characteristic of participants				
Participant-ID	**Job title**	**School type**	**Grade taught**	**Subjects taught**
(SNICT 1)	FP-Educator	Suburb (Non-ICT)	Gr. 1	English, Afrikaans, Mathematics, and life skills.
(SNICT 2)	IP-Educator	Suburb (Non-ICT)	Gr.5 and Gr.6	Natural Sciences & Technology; Mathematics
(SNICT 3)	SP-Educator/ ICT coordinator	Suburb (Non-ICT)	Gr. 6 and Gr. 7	English and Natural Sciences
(SICT 1)	FP-Educator	Suburb (ICT)	Gr. R (Foundation Phase)	English, Mathematics, life skills and Afrikaans
(SICT 2)	IP-Educator	Suburb (ICT)	Gr. 4 and Gr. 5	Natural science and social science.
(SICT 3)	SP-Educator	Suburb (ICT)	Gr. 6 and Gr. 7 (Senior Phase)	Natural Sciences & Technology
(TNICT 1)	FP-Educator	Township (Non-ICT)	Gr. 3	IsiZulu, English, Mathematics and Life Skills
(TNICT 2)	IP-Educator/ ICT coordinator	Township (Non-ICT)	Gr. 4 and Gr. 5	English, Natural Science and Technology.
(TNICT 3)	SP-Educator	Township (Non-ICT)	Gr. 6 and Gr. 7	Mathematics, Technology & Life Orientation
(TICT 1)	FP-Educator	Township (ICT)	Gr. R	life skills, Mathematics, and languages
(TICT 2)	IP-Educator	Township (ICT)	Gr. 6	English.

(TICT 3)	SP-Educator	Township (ICT)	Gr.6 and Gr.7	Xitsonga, and Natural Sciences.
(SNICT M)	Manager	Suburb (Non-ICT)	Gr 4-7	Administration, Management & Leadership, English
(SICT M)	Manager/ ICT coordinator	Suburb (ICT)	Gr. 1-3	Administration, Management & Leadership, life skills, Mathematics, and languages
(TNICT M)	Manager	Township (Non-ICT)	Gr. 4-7	Administration, Management & Leadership
(TICT M)	Manager/ ICT coordinator	Township (ICT)	Gr. 4-7	Administration, Management & Leadership, Mathematics

Explanation of the code in Table 2:

- SNICT 1 – means Suburb Non- ICT Educator 1, SNICT 2 means Suburb Non- ICT Educator 2, ….
- SICT 1- means Suburb - ICT Educator1, SICT 2 means Suburb - ICT Educator2, …
- TNICT 1 - means Township Non - ICT Educator1, TNICT 2 means Township Non - ICT Educator2, …
- TICT 1- means Township - ICT Educator1, TICT 2 means Township - ICT Educator2, …
- SNICT M- means Suburb Non- ICT Manager, SICT M means Suburb - ICT Manager, TNICT M means Township Non- ICT Manager, TICT M means Township ICT Manager.

The study employed a purposive non-random sampling technique to select sixteen (16) participants, comprising twelve (12) educators (75%) and Four (4) school managers (25%). Four (4) public primary schools within the same district region were selected, including two schools from a suburban area (one ICT school and one non-ICT school) and two schools from a township (one ICT school and one non-ICT school).

To foster the integration of ICT into the educational domain, the Department of Education implemented a strategic initiative that involved the selection of schools across both suburban and township areas. These schools were equipped with the requisite ICT infrastructure to facilitate the enhancement of teaching and learning experiences. For the purposes of clarity and brevity, the term 'ICT schools' in this study refers to those institutions that received ICT devices directly from the Department of Education. Conversely, non-ICT schools, which did not receive any ICT

devices from the Department of Education, were obliged to undertake independent initiatives to procure their own devices to advance their teaching and learning practices.

Participants from different phases (Foundation Phase, Grades 1-3; Intermediate Phase, Grades 4-6; Senior Phase, Grade 7) were selected from each school to gain insights into the extent of ICT implementation. School managers were included to assess their role in supporting ICT integration. Participants also included ICT coordinators from the four categories (FP, IP, SP, and managers) mentioned.

The qualitative data gathered was analyzed using systematic techniques, and significant sub themes were extracted. Participants were provided with consent forms to confirm their involvement in the study and were assured of the confidentiality of the information provided. The interviews were transcribed for data presentation and subsequent analysis. The qualitative data/transcripts from the interviews were imported and coded using Atlasti qualitative analysis software. This process involved disassembling the imported data into fragments to identify patterns and frameworks using Atlasti's coding and labelling capabilities. Similar and relevant statements or references were grouped into codes, and codes were further categorized into group codes.

4.2 Sub Themese identified

Sub themes play an indispensable role in qualitative research methodology. They provide a framework for organizing and interpreting intricate and multifaceted data gathered in qualitative studies. By identifying patterns, connections, and overarching themes within the data, sub themes enable researchers to gain a deeper comprehension of the research phenomenon. The utilization of sub themes in qualitative research constitutes a pivotal step in data analysis and interpretation. Through the identification and refinement of sub themes, researchers can uncover profound insights, formulate meaningful interpretations, and contribute to the expansion of knowledge within their respective fields. Common sub themes identified included: (1) Extent of pedagogical ICT integration; (2) Educators' perceptions towards ICTs Integration in teaching practice; (3) Digital platforms used (4) Correlate factors and challenges associated with the Integration of ICTs; (5) Recommendations for promoting effective Integration of ICTs.

4.2.1 Extent of pedagogical ICT integration

Education, as a fundamental pillar of society, plays a pivotal role in societal advancement through knowledge dissemination and the fostering of social cohesion. The concept of education has made substantial contributions to individual and societal progress, and its beneficial impact on society is facilitated by various factors, including the introduction and integration of ICTs. The integration

of ICTs in education holds the potential to revolutionize, accelerate, enrich, and deepen the learning process, while also fostering learner motivation and engagement. This is evident in the enhanced effectiveness and efficiency of education brought about by the introduction of technologies such as smart boards, ZOOM meetings, and online resources like Google. ICTs have the potential to transform teaching, learning, and research methodologies, leading to a more dynamic and engaging educational experience.

Although the advantages of integrating ICTs into education are widely acknowledged, some remain apprehensive. These concerns are often tied to the challenges of implementation, as evidenced by the study participants' reports of limited ICT use despite its integration into their teaching, resulting the extents of its implementation being low and limited. Notably, factors like school type and resource constraints further restrict its implementation. The participants posited that usual traditional teaching practice still persist and prevail owing to limited ICT resources. Many educators and learners still have no or limited access to ICT facilities, an idea which constraint the extent of implementation of ICTs in schools. Few of the participants stressed that the implementation of ICT in teaching and learning is more pronounced among the higher class (Grade 7), and among the ICT school types, owing to their level of availability and accessibility to ICT resources. Better implementation of ICT was reported among participants sampled from ICT school types unlike their counterpart.

These ideas are expressed in the opinions of some of the participants below:

> *…I don't think I can say much about it because we don't have the Internet or labs, but we recently just received a donation from the Emirates, which donated tablets to us of which we haven't used yet. We are still waiting for the formal handover for the tablets. For now, I think, the only time we use ICT is when we go to the admin and ask for the to download and print out some charts and stuff like that..… [TNICT M]*

> *… No, not really. They're not using uh, ICT for teaching and learning. I know I've seen in our phase (Foundation phase), only 2 teachers using ICTs in their teaching. They use the projector to present lessons…. But most of the teachers just do it the traditional way. There are 19 Foundation phase teachers. Only 2 of these teachers use ICTs in their teaching…the rest teach the traditional way. 17 out of 19 teachers don't use ICTs in their teaching…they mainly use the ICTs for administration purposes…. [SNICT 1]*

> *…In our school, ever since I started, we've been using ICT because there are smart boards in all classes. We have programs that are installed by our service*

provider which is BRM (Bongani Rainmaker) with the department. So when we teach any topic from the ATP, you will always find it on the internet, but somebody else delivering the lesson on the video….So when the teacher is not there then there's a substitute that we can be able to also play the video and it will further assist the learners to cover the topic that was supposed to be taught from the content in the absence of the teachers. So, we use ICT everyday playing those videos and some of the information like from YouTube and stuff – so that's it…. [SICT 1]

…At our school, all grades were exposed, but grade 7 learners were exposed more…why? Because they were using the gadgets….Grade fives were not….Grade sixes were not….Grade fours were not…So only grade sevens were exposed more because now their lesson was based more on the use of gadgets…I watch the board, I see what's happening, I jot down important points, I actually go to my gadget, I can even look at the relevant topic….And watch it and listen, grade 7's were exposed more…. [SICT 2]

The data suggests that the extent of ICT integration in pedagogy is currently limited, often due to insufficient infrastructure and resources. As highlighted by the participants, successful ICT integration hinges on adequate support structures. This includes well-equipped classrooms with computers, projectors, and interactive tools, along with readily available ICT resources for educators.

4.2.2 Educators' perceptions towards ICTs Integration in teaching practice

Aligning with the research's aim, an in-depth examination of the participants' ideas and understanding of pedagogical ICT integration was conducted. The participants exhibited a shared perception of ICT integration in the education system. Ten out of sixteen of the participants perceived ICT integration as the utilization of technology (such as desktop/laptops/tablets) as an instructional method, involving the use of various devices such as computers, laptops, smart boards, smartphones, networking, televisions, and audiovisual information. This perception is reflected in their expressed opinions below:

…The integration of ICT is to use the computer/laptop/tablet; you can either have a smart board, maybe in the classroom. Where the smart board can be connected, maybe with all the grade one educators and everybody everything the children can see and watch on the computer, even if the educator is not in the class, but the if the classes are connected, the children in the other class can listen to the lesson while you are just sitting in one class for the other classes to listen to your lesson…[SNICT1]

SNICT1 expresses that pedagogical ICT integration highlights the potential of technology to enhance learning and reach a wider audience. In addition, SNICT1 envisions a scenario where educators can utilize computers and other digital tools to deliver engaging and interactive lessons, even in the absence of a physical educator. This suggests that ICT integration is viewed as a valuable tool for expanding educational opportunities and enriching the learning experience for learners. On the same note, SNICTM, is of the opinion that educator "*…using technology in the classroom enhances educators' teaching through the use of various digital devices that have multimedia, providing that is to achieve your teaching and learning goals…" [SNICTM]*

However, some participants expressed mixed feelings about the use of ICT for pedagogical integration. TICT1 is not sure exactly what ICT integration is all about. The participants provided some assumptions on what ICT integration is. TICT1 commented,

> *…I don't know if I'm correct, but I think pedagogy is about the method of teaching… when we include ICT's method of teaching, including a technology and stuff like that. Networking, audio visual information*…[TICT1]

TICT1 suggests that ICT integration is not a replacement for traditional teaching methods but rather an extension or evolution of traditional teaching methods. Pedagogy encompasses the overall approach to teaching, that can be enhanced and enriched by incorporating ICT tools and resources.

4.2.3 Digital platforms used.

Social media has emerged as a powerful tool with a significant impact on teaching and learning. Its interactive nature and widespread adoption have opened new avenues for educational engagement and knowledge sharing. One of the most prominent roles of social media in education is its ability to foster collaboration and communication among learners, educators, and experts from around the globe. Online forums, discussion groups, and private messaging platforms enable learners to connect with peers, seek clarification from instructors, and engage in real-time discussions. This collaborative environment promotes peer-to-peer learning, enhances understanding, and encourages diverse perspectives. Social media also serves as a rich repository of educational resources. Online platforms host a vast collection of educational videos, tutorials, articles, and interactive simulations, providing learners with access to a wealth of information beyond the confines of traditional textbooks and classrooms. This abundance of resources allows learners to delve deeper into their areas of interest, explore personalized learning paths, and supplement their classroom learning. This what SICT2 and SICT3 commented,

> *...I use WhatsApp a lot. I created a learner's group where I interact with my learners. Most often, I remind them of the question I posted and when will it be*

due. I also encourage them to discuss the problem as a class on this WhatsApp platform… [SICT2]

…With me, I teach using Zoom across the three classes in the grade. I record each lesson and share the recordings to the learners using WhatsApp. Learners that are absent on the day can login and join the class [SICT3] …

Based on the transcript, the educator is using WhatsApp to interact with their learners and facilitate class discussions. They are using the messaging platform to remind learners of assignments, encourage them to collaborate on problem-solving, and foster a sense of community within the class. SICT3 emphasizes the role of technology in facilitating diverse learning approaches. Zoom is employed for conducting live classes, and WhatsApp serves as a platform for sharing lesson recordings, ensuring that absent learners do not miss out. This allows learners to adjust their learning pace and review the material as needed. SICT1, goes beyond the use of WhatsApp and during lesson delivery by using YouTube videos to cement the concept being taught.

…YouTube plays a pivotal role in teaching and learning. I downloaded the relevant short video which I play on the smart board. They provide learners with a combination of visual and auditory aids, which can help them to better understand complex concepts. It helps to extend the knowledge learners have about the concept…[SICT1]

SICT1 emphasizes that YouTube can enhance teaching and learning by providing a combination of visual and auditory aids. This visual-auditory approach effectively complements traditional classroom instruction by adding a dynamic and engaging dimension to the learning process. Complex concepts are often difficult for learners to grasp with traditional teaching methods. YouTube videos, with its multimodality provide a more comprehensive and accessible delivery of information as complex concepts can be further explained through demonstrations, simulations, and visualizations, along with verbal explanations, making learning more impactful and immersive.

However, not all educators benefit from this digital ubiquitous, as some educators' face lack of digital resources within the school setup and among learners. This is what SNICTM and TICT2 remarked,

… Our main problem is lack of digital resources and wi-fi connectivity to all classes. Even though we are a fee-paying school situated in the suburb, we do not have enough money to buy all staff members digital tools to use in their lesson delivery. The learners travel from township communities, where parents have limited access to smartphones, data and Wi-fi... [SNICTM]

Despite its status as a fee-paying institution, SNICTM faces financial constraints that impede the acquisition of necessary digital resources. This financial limitation, in turn, hampers the effectiveness of educators in delivering their lessons. Furthermore, the learners' backgrounds, stemming from township communities, underscore the broader societal issue of limited access to technology among parents, potentially exacerbating the challenges faced by the school. These observations were made by TICT2,

> *At our school, the department only provided the grade 7 educators with laptops, grade 7 learners have tablets, and the grade 7 classes have smartboards. The rest of the grades from grades R-6 do not have any ICTs at all. So, we don't use ICTs in our teaching due to lack of resources and access. The learners live in the township and most learners come from disadvantaged backgrounds. [TICT2]*

TICT2 asserts that there is a lack of ICT resources at the school, which is preventing educators from using technology in their teaching. The school only provided ICTs to the grade 7 educators and learners, and the other grades have no ICTs at all. The learners come from disadvantaged backgrounds and live in a township, which may further limit their access to technology outside of school.

4.2.4 Correlate factors associated with the Integration of ICTs

Integrating ICT into teaching presents a unique set of challenges for educators. One significant challenge is the transitioning from traditional teaching methods to modern teaching, the lack of adequate access to ICT resources, such as computers, projectors, and reliable internet connectivity. Without these essential tools, educators are hindered in their ability to utilize ICT effectively in their classrooms. Furthermore, many educators lack the necessary training and support to effectively integrate ICT into their teaching practices. This can encompass both technical proficiency and pedagogical expertise, as educators need to understand how to seamlessly blend technology into their lesson plans and teaching methodologies. Additionally, socioeconomic disparities can exacerbate existing educational inequalities due to lack of access to ICT resources and connectivity that varies greatly across different socioeconomic groups in South Africa. Within this category, transitioning from traditional methods to ICT was prevalent among the participants, particularly educators.

4.2.4.1 Transition from traditional teaching methods to modern teaching

Conventional teaching approaches often lean towards passivity, educator-centricity, and an emphasis on rote memorization, whereas 21st-century classrooms prioritize active learning, learner

engagement, and the cultivation of critical thinking and problem-solving abilities. Despite being in the 21st century, many educators continue to adhere to traditional methods and find the transition to modern teaching using ICTs challenging. ICTs embody a fundamental shift in pedagogical approaches that is revolutionizing the way educators impart instruction and learners engage in the learning process. Traditional teaching methods, often reliant on instruction and textbooks, have been the cornerstone of education for centuries. However, the advent of ICTs has introduced a wealth of new tools and resources that can be utilized to create more dynamic, interactive, and personalized learning experiences. Despite these promises that ICT seem to provide for teaching in the 21cetury, educators still find it difficult to move from their current teaching pedagogical practice. SNICT 2 and SICT M opined.

> *There is a lot that needs to be done in teaching using ICTs. You need to know how to connect or operate electronic devices such as connecting a computer to a projector. Projectors are not mounted in classes; one needs to carry them around. Sometimes, there are technical glitches that end up affecting the lesson procedures. Whereas using traditional methods is easy. You just get into the classroom and start teaching [SNICT 2]*

> *In as much as teaching with ICT is applauded these days, but it consumes a lot of time as it needs a lot of preparations. Grade seven learners do not take their tablets home, instead, the educator collects them at the end of the day to recharge. As the class starts, the educators need to hand them to the learners, and sometime some are not fully charged and cannot connect. [SICT M]*

SNICT 2 suggests that while traditional methods offer ease of use, ICT presents a valuable opportunity to enhance teaching and learning. However, the successful integration of ICT requires educators to overcome technical challenges and develop the necessary skills to utilize it effectively. SICT M expressed that despite the widespread recognition of the benefits of integrating ICTs into teaching practices, SNICT 2 highlights the inherent time constraints associated with this approach due to the preparatory measures involved. Notably, grade seven learners do not take their tablets home for charging; instead, the educator collects them at the end of the day for this purpose. Consequently, the start of each class involves the distribution of tablets to the learners, a process that can be disrupted by incomplete charging or connectivity issues, ultimately impeding the flow of instruction.

Educators that were trained before the digital era are reluctant to use ICT in the classroom. They always view such pedagogical innovations as done by young people who have just joined the profession. TNICTM and SNICT1 expressed,

Young educators that have joined the teaching fraternity recently are keener on using ICT in teaching, however, older educators are reluctant. These young educators already have skills of using technological devices, yet the older ones are still in the process of learning on how to use them. [TNICT M]

I am almost towards my retirement, and to start learning new teaching methods is a challenge, particularly the ICT ones. I try to use ICT, but I find it challenging because of my limited knowledge and skills. I am also technophobic. I see using computers taking up a lot of my time. [SNICT 1]

TNICTM suggests that newer or younger educators who have recently entered the teaching profession are more enthusiastic about incorporating ICTs into their teaching methods. In contrast, older, more experienced educators are hesitant or resistant to adopting these technological approaches. The reason for this divide is attributed to the fact that younger educators already possess skills in using technological devices, while older educators are still in the process of learning how to use them. SNICT1 acknowledges attempting to use ICT but faces difficulties due to limited knowledge and skills. Additionally, the participant admits being technophobic, expressing a fear or aversion to technology. The concern is that using computers adds to the challenges they already encounter in the teaching profession.

4.2.4.2 Educator training, competency, and support

In the South African school setup, ICT educator competency skills play a pivotal role in fostering a dynamic and technologically enriched learning environment. Educators need technical proficiency, encompassing the adept use of digital tools and devices integral to modern education. Beyond technical know-how, digital literacy is essential, ensuring educators can effectively incorporate digital resources into the curriculum. Adaptability is key, as educators must stay current with emerging technologies through continuous professional development. Classroom management skills involve organizing and securing ICT resources while promoting a safe digital learning space. Educators should possess pedagogical knowledge to align technology with diverse teaching methodologies. Despite the emphasis on implementing ICT integration in the classroom, there are teachers who don't have basic skills to operate a computer. TICT2 highlighted that.

Right now, we still have teachers who can't even open a laptop, or they can't make use of a computer, so for them it's a disadvantage. When we allocate teachers for grade 7, they don't want to go there because they know that they must use a smart board and it'd be a challenge for them because they can't even use a laptop. I think with the rest of the younger generation teaching grade 7,

most of them had to familiarize themselves with the smart boards and where they find a challenge, they can ask around. [TICT 2]

Moreover, an emphasis on digital citizenship ensures learners engage responsibly and ethically in the online world. Collaboration and communication skills are crucial, facilitating effective engagement with learners and colleagues through digital platforms. Problem-solving abilities, innovative approaches, and a seamless integration of technology into assessment and feedback processes further characterize the comprehensive skill set needed by ICT educators in the South African educational context. SNICT M and TICT M highlighted.

As school managers, we identify areas for our staff's professional development. Equipping our staff with ICT skills for teaching and learning was prioritized. We participated in an internal computer training course offered by a school educator which equips us with the basic skills to operate Microsoft Word for typing worksheets and assessments, Excel for recording marks, PowerPoint to present lessons, and how navigate the internet to download videos and for research purposes… [SNICT M]

…The whole school has had training that the Department of Education organized with a service provider. Educators were trained in the functionality of laptops, functionality of tablets, how to use smart boards, on Microsoft Word, Excel, and PowerPoint. And then they were also trained on how to apply it in class, like for example Google forms, using multimedia and how to download videos…however, the training duration was short and compacted. Many materials were forced to be covered in a short space of time, leaving educators absorbing very little from what was coming from the workshop [TICT M]

The school is actively addressing the need for enhanced digital literacy among its teaching staff, as evidenced by SNICT M's observation. While some educators may be hesitant to embrace technology due to unfamiliarity or perceived irrelevance, the TICT M's assertion that educators have been equipped with the necessary digital skills and knowledge suggests the initiative to promote the of use technology into teaching practices. However, these two school managers did not specify how the training was effective for ICT pedagogical integration. SNICT2 is not satisfied with the training received as it skipped a lot of technical aspects, as reflected below,

I don't really use ICTs to teach because I do not have the skills of connecting computer gadgets such as a laptop to projector. Although I do use my personal laptop for typing worksheets and assessments, I don't know how to prepare and

implement interactive lessons like VR and AR lessons for learners using computer software applications. [SNICT 2]

SNICT 2 expressed reluctance to use ICTs in teaching due to challenges such as lack of technical proficiency in connecting a projector and a lack of expertise in creating interactive lessons using ICT tools to promote curriculum integration. While the personal laptop is utilized for basic tasks such as typing worksheets and assessments, limitations in incorporating ICTs into a more engaging and interactive learning environment is acknowledged. In other words, the participant displays limited knowledge for preparing interactive and engaging lessons using the computer applications.

It was about using ICTs in the classrooms. However, the training was mainly based on Microsoft suite programs such as Microsoft Word, Excel, PowerPoint, and use of the internet. It was a basic course. There was no demonstration on how to use MS word for teaching and learning. Lessons are conducted through virtual platforms such as ZOOM, however, there is limited interaction between the educator and learners and learners among themselves. I heard about virtual reality (VR) and augmented reality (AR), but I am not sure what exactly they are and how to use them. The skill that we learnt is to use basic applications for administrative purposes in lesson presentations. It is a challenge to integrate them for effective teaching. [SICT 2]

SICT 2 recognized that a training session on the application of ICTs in classrooms was conducted, with a particular focus on Microsoft suite programs like Word, Excel, PowerPoint, and internet usage. However, the training seemed to be very basic, lacking detailed guidance on utilizing Microsoft Word for educational purposes. While virtual platforms like Zoom are employed for lesson delivery, there are limitations in interaction between educators and learners, as well as among learners themselves. The skills gained during the training appear to be more oriented towards administrative tasks and lesson presentation using Microsoft suite applications, rather than harnessing these technologies to create more engaging and impactful teaching and learning experiences.

Furthermore, the participants posited that the supports including technical assistance, ICT training program, and the provision of ICT facilities provided by external bodies and school management helps to shape the direction and interest in ICT, and consequently, its integration by educators in their teaching. SNICT 2 and TNICT1 opined that;

I think through a very large extent, I think managers of schools are responsible for shaping the direction in which education moves and we are in the age of

technology, and it is the manager's responsibility to ensure that education and the school is moving in that direction and to develop that ethos. So, managers are fundamentally responsible for that. [SNICT 2]

Management encourages teachers to use the ATPs to teach their lessons- it is their own initiatives how they deliver these lessons, but then to enhance the lesson, they download some videos to make their lesson more relevant and exciting for learners…. But we don't compel the teachers to use ICTs. They will teach however they are comfortable. [TNICT 1]

School managers play a crucial role in driving successful ICT integration within schools. Their support and motivation for teachers are essential. By providing resources, training, and fostering a culture of innovation, managers empower teachers to leverage technology effectively in the classroom. This ultimately leads to a more engaging and enriching learning experience for learners.

4.2.4.3 Limited access to ICT resources

ICT resources have revolutionized the teaching and learning landscape, offering a plethora of benefits that enhance educational experiences. ICT resources, encompassing digital tools, software applications, and online platforms, provide educators with a diverse range of pedagogical approaches to engage and empower learners. One of the most significant advantages of ICT resources lies in their ability to personalize learning. With access to a vast array of digital content, learners can tailor their learning journeys to their individual needs, interests, and learning styles. ICT resources enable educators to differentiate instruction, providing learners with multiple pathways to grasp concepts and develop skills. ICT resources also foster collaboration and communication among learners, breaking down geographical barriers and promoting global connections. Online forums, interactive platforms, and collaborative tools allow learners to engage in peer-to-peer learning, share ideas, and work together on projects, enhancing their communication and teamwork skills. Furthermore, ICT resources provide learners with opportunities to develop critical thinking and problem-solving abilities. By engaging with simulations, interactive games, and real-world data analysis tools, learners can apply their knowledge to solve complex problems, think critically, and make informed decisions. Despite the advantages that ICT offers, some schools have limited access to such resources. TICT 2, SICTM and SNICTM criticize the system of accessing digital tools despite being an ICT school as indicated below,

Only Grade Seven educators and learners have access to the digit tool devices. The rest of us do not have access to such privileges. Surely, how do you expect us to integrate ICT where you do not have one. [TICT 2]

> *In our school, the laptops are now old and not compatible with the recent applications. We were given these laptops in 2016, and since then, they have not upgraded. Now they are white elephants. [SICT M]*

> *We fall short in poor infrastructure and a lack of ICT resources not only in the set-up of just having the necessary equipment, but we lack funding to maintain the resources and the infrastructure. [SNICT M]*

Within the schools, there is an unequal distribution of access to ICT devices. Only Grade Seven educators and learners in the township ICT school have the privilege of utilizing digital tools, leaving the rest of the school community without such access. This disparity acts as a hindrance to the integration of ICT for a significant portion of the school population. In the suburb ICT school, the laptops provided to educators in 2016 have become outdated and are no longer compatible with newer applications. This obsolete technology poses a challenge to educators, limiting their ability to effectively incorporate ICT into their lessons and restricting the range of pedagogical approaches they can employ. Furthermore, there is a lack of upgrades and support for these outdated laptops, indicating a deficiency in investment in ICT infrastructure. This lack of support further obstructs the seamless integration of ICT into the teaching and learning processes. In the township non-ICT schools, the digital tool resources are limited to administration and senior management. TNICTM and TNICT3 gave a similar comment about limited access to ICT infrastructure,

> *There are ten (10) laptops in our school. These laptops are distributed to the principal, deputy, and the administration staff. This means that the rest of the educators do not have access to these resources. [TNICT M]*

> *None of our educators have access to digital devices. We depend on the admin for typing and printing question papers and worksheets. We cannot use materials from YouTube as we do not have projectors and Wi-Fi. If we need to download some information using our smart phones, we need to go to the admin area. [TNICT 3]*

TNICTM indicates a limited distribution of resources in the school. Out of the ten laptops available, they are allocated to specific members of the staff, including the principal, deputy, and administrative staff. This allocation results in other educators not having access to these laptops. TNICT3 confirms the scarcity of digital resources for educators. None of the educators have access to digital devices, and they rely on the administration for basic tasks like typing and printing question papers and worksheets. The absence of projectors and Wi-Fi means that educators cannot use materials from platforms like YouTube for instructional purposes. Even for downloading information using smartphones, educators are required to go to the administrative area, implying a

lack of individual access to digital resources. Both participants highlight a significant disparity in access to digital tools and resources among educators in the school. The limited availability of laptops and the absence of essential devices like projectors and Wi-Fi create challenges for incorporating technology into teaching and learning practices. Educators seem to heavily rely on the administrative staff for basic digital tasks, indicating a need for more equitable access to technology across the teaching staff.

Concerning **Internet Problem**, the participants generally stressed that effective integration of ICTs partly depends on internet availability. SNICT1 and TNICT 3 opined that lack of adequate internet accessibility often constraint the implementation of ICTs in teaching.

> *Another challenge is poor Internet connection throughout our school. But we did try to sort it out- but still not all classes can pick up the internet due to poor network coverage. My class will does not have internet access. I'm struggling to access Internet in my class, so most of the time if I want to show children something, I must go out of my class maybe near the office where I can access the Internet…. So, in my class that's the biggest challenge that I'm having - the Internet is a very big challenge in my class. I'm struggling with the Internet connection, but, otherwise, the school does have Internet. So, whatever I want to present to my children, I do use the laptop to present the lesson. [SNICT 1]*

> *We have Wi-Fi but we don't access it as it doesn't cover where we are. There is no coverage. Even if I come with my own computer or laptop, I won't be able to access the Wi-Fi. If I want to access the internet, I need to go to the admin area and by going to the admin area; I am losing the contact time with the learners. If the Wi-Fi covered the whole school, it'd be much easier. [TNICT 3]*

Another noteworthy barrier is the incidence of **load shedding**. On this note, the study participants SICT 2 and TICT 3 posited that:

> *Load shedding- It's the number one... So when we that plan of delivering the lessons, then electricity goes off….It's now a problem- In this 30 minutes that we have… remember you have only 30 minutes per period, and then within that period, now you have to meet with the teachers in the other classes and inform them that the lesson that you were supposed to deliver, cannot be delivered as planned…and now they have to deliver the lesson- they are not going to deliver the lesson as you would have, …so now this becomes a serious challenge in terms of delivery of lessons in the event of a power outage. [SICT 1]*

And one other one, a challenge is that of, sometimes teachers do not have… especially now in load shedding you are teaching, and the electricity is off, and you were using the smart board. In most of the Grade 7 classes we no longer have white boards, so once the electricity is off, sometimes they take long to switch on the generator. It becomes a challenge, and it consumes time. [TICT 3]

4.2.4.4 Policies for ICT integration

South Africa has emphasized the integration of ICT in education, focusing on curriculum alignment, educator training, infrastructure development, and efforts to bridge the digital divide. The Department of Basic Education (DBE) has been involved in various policies and initiatives to enhance the use of technology in schools, aiming to provide equitable access to ICT resources and improve overall learning outcomes. There are different interpretations of the ICT policies leading to different implementation at school levels. This is what SNICT2, SICTM, TNICTM, SICT3 respectively mentioned,

I am aware that there is a 2004 White Paper on e-Education, however, I am not too acquainted with the policy as I feel it was not relevant to our school. I am not sure that there is a school ICT policy as it was not exposed to us. Although we are in a digital driven era, we are aware that we should integrate ICT into teaching and learning, however, we are clueless on the implementation process. The use of technology to teach is left to the individual…. [SNICT 2]

I do not really know the details of the ICT policy in education and as such I cannot comment explicitly on how far ICTs should be integrated in teaching and learning in schools. However, the school does have its own ICT policy where its contents include asset management and maintenance. The school policy does not mention the integration of ICT into teaching and learning. The DoE has asked that we have the ICT policy in schools, and we complied and have them kept in our files.
[SICT M]

As a manager in the school, I heard about ICT policy in education, however, I think it is generic and does not talk to us since we are non-ICT schools. Thus, we do not pay much attention to it. [TNICT M]

I am not aware of the 2004 White Paper on e-Education. But I think it speaks about the use of technology in the workplace. As for our school policy, I have never seen an ICT policy. We haven't received any communication from the

school management regarding a school ICT policy and therefore, I am not aware of the content and objective of the policy. [SICT 3]

SICTM conveys a lack of awareness regarding the specifics of the ICT policy in education, acknowledging a deficiency in information to explicitly comment on the degree to which ICTs should be incorporated into teaching and learning in schools. Similarly, TNICTM expresses similar sentiments, indicating a perception that the ICT policy is generic and not tailored to non-ICT schools. As a result, the manager suggests that the school community pays little attention to the policy. This shared perspective emphasizes a potential gap in communication or understanding between educational authorities responsible for ICT policies and the practical on-the-ground reality (context) in schools. It underscores the significance of ensuring that ICT policies are well-informed and pertinent to the diverse contexts of various schools, aiming to facilitate meaningful integration and impact. SNICT M commented that ICT policy markers do not put socio-economic status of the schools into consideration.

Although we are a school-fee paying school in the suburbs, most of our learners come from the townships. The rate of school fee payment is very low. This leaves the school with low budgets to be able to buy each educator a device. The ICT policy requires that we include technology in our teaching, however, our learners come from low-socioeconomic backgrounds. It is a challenge to implement what the ICT policy wants in a heterogeneous terrain. [SNICT M]

Despite being a fee-paying school in the suburbs, most learners at this school come from low-income townships. This results in a low rate of school fee collection, limiting the school's financial capacity to provide each educator with a personal device. The education ICT policy mandates the incorporation of technology into teaching practices; however, this poses a challenge due to the diverse socioeconomic backgrounds of the learner body.

4.2.5 Recommendations for promoting effective Integration of ICTs

Consequent to various barriers identified by the study participants as limitations towards the Integration of ICTs in School, various recommendations were proposed for promoting effective Integration of ICTs. These recommendations as identified by the participants are examined as follows:

4.2.5.1 Providing Adequate ICT Resources

Provision of adequate and essential ICT facilities and infrastructures are pertinent to ensuring successful implementation and integration of ICTs in schools. By providing ICT tools including Personal Computers, ICT Lab, Projector etc., educators and students in the school will be encouraged towards the achievement of ICTs objectives. As recommended by few of the

participants, the effort of Department of Education and the School management should be directed towards ensuring availability of adequate and sufficient resources in the school. This will enable the educators and students to have access to ICT equipment and consequently its usages and integration in teaching and learning. This idea is reflected in the opinions of SNICT 3 and SNICT 2

> *…Also, resources for… for myself because we obviously…. we can't speak of ICT integration without speaking about the teachers having resources… because from my instance… I'm using my personal laptop. I don't have the resource from the school, so then if I did not have the personal one then there was no way I would have been able to use ICTs in my classes. So, support in terms of Management- resources should also be given to the teachers… [SNICT 3]*

> *…I think the starting point would be in revamping of all the classrooms in moving towards whiteboards...and every class having a projector…we do have Wi-Fi connectivity…. but we need those resources in place. Or maybe let's say sufficient resources to be provided to implement what we have been trained in…. because not that we don't have it, just need more. And need more to be available to people. [SNICT 2]*

4.2.5.2 Providing regular update and maintenance of resources:

In line with the above claim, provision of adequate resources should be supported with regular update and maintenance of the resources. When the resources are not maintained and updated, they become obsolete and inefficient in ensuring continuity in the process. In view of one of the participants, lack of proper maintenance and update of facilities will pose threat on the effective implementation of ICTs in teaching, as the available resources may depreciate and become obsolete over time, which may affect effective teaching and learning activities. On this note, TICT 1 and SICT M posited that:

> *Then the department must also consider upgrading and updating our resources regularly. They should not be obsolete. And they must also provide us with sufficient resources for all teachers. [TICT 1]*

> *What must happen is that they must take these laptops and give us new, updated laptops. Now, as to a level, that's when I realize that if you buy a laptop today, it's not suitable after 2-3 years, it's not suited. I realized that gadgets become obsolete, sometimes you look at it, it's new, it's performing, but according to the new trends, It's no longer good enough. So, I think if the department can now and then agree that – say…we are going to use the laptops for 3-5 years, and*

then after we are taking it, we're giving you an upgraded one. That will be more suited. [SICT M]

4.2.5.3 Provision of adequate ICT training for Educators

The lack of adequate knowledge and experience regarding ICT featured significantly in the opinion and recommendation of some of the participants for promoting ICT integration. They argued that poor computer knowledge among some educators prevent effective and efficient use of ICT facilities where it is available. Oftentimes many educators are discouraged to adhere to ICT policy and utilize the ICT tool owing to their poor knowledge and experience of ICT programs. Thus, few of the participants suggested the need to embark more on initiative or ICT training program for the educators, to enlighten and improve their knowledge regarding the use, implementation, and integration of ICT in aiding teaching and learning. The ideas of TICT M and SNICT 3 regarding this claim are expressed below:

I think a person can't get enough training. I think the department hasn't done enough for the ICT schools to train us on how to create our own content, especially for other grades that don't have smart boards. Okay, yes, I might have my own laptop which I'm using at school, but they haven't given me enough information on how to create my own content or how to search information for my subject, I've had to teach myself that. Whereas other teachers who are negative can't even Google simple information on the laptop, so I think they still need to give us more training. The older teachers are fortunate to have laptops. So, I think if we can have a workshop maybe for beginners and intermediate so that we are all on par. [TICT M]

Then taking us to more trainings, where we can learn and develop ourselves better…. Especially because now, we live in a technological world and children must obviously, especially our children have a chance to tackle technology…. and I have some sort of experience with it, but then I guess… it… it starts with the teachers first……Yeah, so that would be the support that I really needed. [SNICT 3}

Similarly, SICT 2 opined that equipping parent with basic knowledge of ICT through adequate training program will helps to aid the integration of ICT in teaching and learning. It will enable parent to assist and aid the learning of their kids when they are at home.

Yes, I think having workshops for our parents to show them how the devices are utilized. We include them through the parents meeting and let them know about WhatsApp messages and how things have changed so that they can also

participate in the teaching and learning of their kids. If I could get a sponsor for the parents, I would. [SICT 2]

4.2.5.4 Improve learner accessibility to system.

In addition to the aforementioned claims, TICT 2 reported that improvement in learner accessibility to ICT resources will play a significant impact towards smooth transition into ICT integration in the school.

I think, well maybe ensuring that when ICT is integrated the children also have some sort of access to it, because sometimes it would be nicer to choose other programs in the class, maybe to even check for understanding where they… they fill in something online… submitted online. That will be moving towards the smooth transition to ICT integration. [TICT 2]

4.2.5.5 Ensuring Uniformity through adequate monitoring of staffs Activities

Ensuring the strict adherence and compliance of staffs including educators with ICT policy and objectives will aid the integration and implementation of ICTs in education. SNICT 3 and SICT 3 argued that adequate monitoring of staffs towards ensuring their compliance to the implementation of ICT rules will promote the integration of ICTs in school. By enforcing compulsory staff usage of ICTs, evaluating their activities in term of compliance, and by providing them adequate supports will promote ICTs integration in the school. SNICT 3 and SICT 3 expressed;

Well, that's interesting to know because this ties up then with what you mentioned right at the beginning about uniformity, that there is no monitoring and therefore, because there's no compulsory monitoring as such, then there is no uniformity. But should there be monitoring and support in terms of evaluation of usage, then maybe there will be some form of uniformity. [SNICT 3]

Yeah, yeah, and some teachers actually go to class even if you are not prepared to use ICT…Everything that is in front of you is ICT related…So there's no way - you must just use them, because if you don't use them, you won't present your lesson….you have to use it to actually now project and present your assessment as you are compelled to use ICTs…You do you find yourself with no alternative. However, there is room for improvement to use ICTs more often and to advance the level of usage. That can happen if there is a compulsory use of ICTs because teachers will be required to meet certain expectations from the school and from management. [SICT 3]

In line with the above claim, SICT M reported the need for increase in manpower as a possible recommendation for effective integration of ICT. The participants stressed that while implementation of ICTs in teaching may be attributed with high workload and adequate knowledge of ICT, staff may be overburdened by their responsibilities. Thus, the increase in the number of staffs will reduce the workload on the educators, help to oversee the level of educators' compliance and usage of the ICT, and promote effective integration of ICTs in their teaching.

> *I think that if they bring more manpower to only assist us with managing the whole ICT program so that we are not overburdened… You know, we need to plan, we need to teach, we need to assess, we need to mark and capture marks, we need to assist learners in need of extra support and it is also very time consuming …it is just too much and therefore, I say, we definitely need more manpower to manage the ICTs and to oversee whether the teachers are really using the ICTs or are teaching ZOOM you know, because there isn't anyone to actually walk around to monitor the ICT usage by individual teachers….we are human beings with various challenges like being absent, being sick, being late to class, being unprepared for the lesson, you know, but due to a shortage of manpower- these may happen- and if there is no monitoring then people just do as they like- this defeats the whole purpose of being an ICT school… In this way ICT integration may not necessarily be effective. [SICT M]*

4.3 Summary of major findings from data presented

The comprehensive analysis of the data has shed light on the multifaceted landscape of ICT integration in the sampled schools. Through an exploration of the key sub themes such as educators' extent of pedagogical ICT integration, educators' perceptions towards ICT integration, the various digital platforms used, Correlate factors associated with the integration of ICTs, recommendations for promoting effective integration of ICTs, this study has effectively synthesized a cohesive understanding. These findings not only address the specific research questions but also offer profound insights into the broader implications of ICT integration. The data helps to construct a robust framework for conceptualizing the transformative potential of ICTs in educational settings. The data presented in this section serves as a foundation for leveraging technological advancements to cultivate improved learning outcomes and engender innovation within the educational sphere. As we navigate the complexities of the digital age, these insights serve as a compass, guiding us toward a future where ICTs empower educators and learners alike to thrive in an ever-evolving educational landscape.

Chapter Five: Data analysis and findings

5.1 Introduction

This chapter dissects the collected information, unveiling the intricate tapestry of patterns, themes, and insights woven within. The raw data (Chapter Four) was transformed into meaningful knowledge, as we illuminate the impact of resource allocation and standardized pedagogical approaches on ICT integration. These findings helped to get closer to the aim: developing a conceptual framework/model that transcends limitations and empowers effective ICT integration across diverse educational landscapes. In addition, the chapter discussed the findings leading to the adopted themes.

5.2 Data Analysis

Data analysis is a process of understanding the collected data using statistical treatment (quantitative) or thematic analysis (qualitative) to come up with meaningful conclusions that satisfy the objectives of the research. According to Baraceros (2015), data analysis is a process of understanding data or known facts or assumptions serving as the basis of any claims or conclusion about something. Data analysis is often deemed the most intricate and enigmatic phase of a qualitative project, receiving comparatively little thoughtful discussion in literature (Thorne (2000) in Kiger & Varpio, 2020). Further research by Graue (2015), qualitative data analysis involves describing, classifying, and interconnecting phenomena using the researcher's concepts. Initially, a precise description of the phenomena is necessary. The researcher must interpret and explain the data, requiring the development of a conceptual framework for data classification. Subsequently, concepts are constructed and linked to each other in the analysis process. Flick (2013) describe the qualitative data general aim as "… a phenomenon in some or greater detail Comparing several cases on what they have in common or on the differences between them Develop a theory of the phenomenon under study from the analysis of empirical material" (p. 4). In qualitative data analysis, the focus is on interpreting meanings rather than dealing with raw numerical data. Sources such as unstructured interviews with individual participants were utilized in the research. The process of conducting interviews resulted in the generation of interview transcripts from audio recordings. Qualitative data analysis approaches typically involve four key steps: data collection, data reduction, data displays, and conclusion drawing/verification (Graue, 2015). Data is collected through interviews or observation. The magnitude of collected data may pose a significant challenge, emphasizing the critical importance of meticulous documentation (Sivarajah et al.,2017). Data reduction involves reducing the amount of data to a manageable size while still preserving its meaning (Graue, 2015). This can be done through techniques such as coding and categorization. Coding is the process of assigning labels to data segments. Categorization is the

process of grouping data segments into sub themes. The coded data was used to create themes. Thematic data can be used to make the data more meaningful and easier to understand.

5.3 Thematic analysis

Thematic analysis is a widely used method for analyzing qualitative data in a variety of research disciplines (Braun & Clarke, 2006). It is a flexible and adaptable method that can be used to identify, analyze, and interpret patterns or themes in data (Nowell, Norris, White & Moustakas, 2017). Thematic analysis is a qualitative data analysis method that involves exploring a dataset to identify, analyze, and report recurring patterns (Braun & Clarke, 2006). Putting it differently, thematic analysis incorporates interpretation during code selection and theme construction. One notable aspect of thematic analysis is its adaptability, making it suitable for various theoretical and epistemological frameworks. The researcher draws conclusions from the data and verifies their findings. This may involve checking for coding reliability and conducting member checks. The core of thematic analysis is examining relationships between data segments. At this point, the researcher stops describing the data and starts explaining why things are as they are. Nowell et al., (2017) identified six-phase process of Thematic analysis as follows:

- **Familiarization**: Read and re-read the data to become familiar with it.
- **Coding:** Assign codes to segments of data that represent important themes or concepts.
- **Searching for themes:** Identify and organize the codes into potential themes.
- **Reviewing themes:** Review and refine the themes to ensure they are internally coherent and externally valid.
- **Defining and naming themes:** Define and name the themes clearly and concisely.
- **Writing up:** Write up the findings of the thematic analysis concisely (Clarke & Braun, 2013).

5.3.1 Defining a theme.

A theme is a patterned response or meaning (Braun and Clarke 2006) derived from the data that informs the research question. In contrast to categories, which provide description and organization to the "manifest content" of a dataset, themes are more abstract entities that demand a higher level of interpretation and integration of data (Nowell et al., 2017). When conducting thematic analysis, researchers can identify themes regardless of the frequency with which a particular idea or item related to that theme appears in a dataset. Additionally, the significance or centrality of a theme is not necessarily determined by its frequency within the data (Braun and Clarke, 2006; Nowell et al., 2017). Themes can be categorized as either semantic (often referred to as manifest), which address more explicit or surface meanings of data items, or latent, which

reflect deeper, underlying meanings, assumptions, or ideologies. From data collection, two main themes strongly appeared, that is, infusion of digital technology in instruction (whereby it highlights the integration of technology with content and teaching methods) and barriers to ICT integration in the classroom (emphasizes the broader scope of challenges).

5.4 Theme 1: The infusion of digital technology in instruction

Digital technology's infusion into instruction reshapes classrooms, sparking debate between its transformative potential and potential pitfalls (Almufarreh & Arshad, 2023). The infusion of digital technology in the classroom has profound implications for modern education, ushering in a transformative era that transcends traditional teaching methodologies. The integration of digital tools, such as interactive whiteboards, tablets, and educational software, facilitates a dynamic and engaging learning environment. His shift empowers educators to cater to diverse learning styles, fostering personalized learning experiences for learners. Furthermore, digital technology enhances collaboration and communication among learners and educators, breaking down geographical barriers and promoting global connectivity. Recent studies (Timotheou et al., 2023; Cheng et al., 2023) underscore the positive impact of digital technology on academic achievement, as it enables interactive and immersive learning experiences. Additionally, the incorporation of digital resources equips learners with essential 21st-century skills, including digital literacy and critical thinking. However, challenges such as the digital divide and privacy concerns must be addressed to ensure equitable access and safeguard learners' information. In conclusion, the infusion of digital technology in the classroom holds the promise of revolutionizing education by fostering innovation, individualization, and preparing learners for the demands of a digital age.

Interactive tools like virtual reality (VR-immerses completely in a digital world) and simulation ignite engagement, catering to diverse needs and fostering essential 21st-century skills like critical thinking, problem-solving, communication and collaboration (Chang & Hwang, 2023; ISTE, 2020). Global connections, personalized learning paths, and access to vast information empower learners in ways unimaginable even a decade ago (Zhao et al., 2022). The future demands a nuanced approach, one that leverages innovations like AI-powered learning and immersive. Augmented Reality (AR), unlike Virtual Reality (VR) which immerses users entirely in a digital world, enhances the physical environment with additional layers of information and visuals. This blending of digital and real-world experiences holds immense potential for transformative learning (Visscher et al., 2023). However, ethical considerations and prioritizing human interaction remain crucial to ensure well-designed learning journeys (Castelhano et al., 2023). AR's ability to overlay digital elements onto the physical world creates engaging and interactive learning experiences, fostering deeper understanding and knowledge retention. For instance, learners can visualize historical figures in their classrooms, dissect virtual models of biological systems, or explore

complex mathematical concepts through interactive overlays. This augmented learning goes beyond traditional memorization, promoting critical thinking, problem-solving, and spatial reasoning (Chang & Hwang, 2023).

However, ethical considerations surrounding data privacy, information overload, and potential addiction to AR experiences must be addressed (Visscher et al., 2023). Additionally, prioritizing human interaction and social engagement alongside technological integration is crucial. AR experiences should not come at the expense of face-to-face interaction, collaborative learning, and critical reflection necessary for holistic development (Castelhano et al., 2023). Therefore, effective AR integration in education requires a balanced approach. Leveraging its immersive and interactive capabilities while upholding ethical principles and ensuring meaningful human interaction will unlock the true potential of AR for creating transformative learning experiences that equip learners with the knowledge and skills needed to thrive in the digital age.

While participants expressed awareness of AR and VR technologies, they acknowledged limitations in implementing them due to a lack of knowledge and skills. This highlights a crucial aspect of successful technology integration: achieving a balance between its pedagogical potential and its practical limitations. By carefully considering these factors, we can ensure that technology empowers educators to create truly equitable and transformative learning experiences for all learners.

The integration of ICT knowledge within a classroom setup is a pivotal aspect of modern education, shaping the way learners learn and educators instruct. ICT encompasses a wide array of tools, including computers, tablets, software applications, and internet resources, all designed to enhance the educational experience. Recent research (Qu & Chen, 2021; Alam, 2023) emphasizes the importance of effective ICT integration in fostering a more interactive and learner-centered learning environment. Educators equipped with robust ICT knowledge can employ innovative teaching strategies, such as blended learning, flipped classrooms, and online collaborative projects, catering to diverse learning styles and promoting active engagement (Bizami, Tasir & Kew, 2023; Renau, 2023). Moreover, ICT integration equips learners with essential digital skills, preparing them for the demands of a technology-driven society.

The successful integration of ICTs in classrooms on a global scale has become increasingly evident, with numerous studies highlighting positive outcomes. Recent research by Wang et al. (2020) showcases exemplary cases where ICT integration has led to transformative educational experiences. In these instances, classrooms have embraced digital tools such as interactive whiteboards, online learning platforms, and educational software, fostering dynamic and collaborative learning environments. Educators equipped with advanced ICT skills have

effectively incorporated technology to personalize instruction, adapt to diverse learning styles, and promote critical thinking among learners. Moreover, the global reach of ICT has facilitated cross-cultural collaboration and knowledge sharing, breaking down geographical barriers and preparing learners for a globally connected world. These success stories underscore the potential for ICT to revolutionize education by enhancing engagement, expanding access to information, and cultivating essential 21st-century skills (which are a set of competencies and abilities that are considered essential for success in the modern world. These skills go beyond traditional academic knowledge and include a combination of cognitive, social, and emotional proficiencies).

Table 3 summarizes the diverse digital platforms mentioned by participants from the sampled schools. This information sheds light on the preferred online environments used by this population for various purposes.

Infusion of digital technology in instruction	**Participants**
Laptops/tablets/smartphones Integration in Education	8
The interactive smart boards in education	5
Virtual Reality	0
Coding and Robotics	2
Educational Apps and Software	10
YouTube and Videos in the Classrooms	7
Video Conferencing: Zoom and Teams	4
WhatsApp in Contemporary Teaching and Learning	8

Table 3 Digital platforms applied in the schools by participants.

Figure 4 provides a visual representation of the data presented in Table 3, highlighting the most frequently utilized and preferred digital platforms among study participants. This graphical format facilitates easier identification of prevalent trends and enables a more nuanced understanding of platform preferences within the sample population.

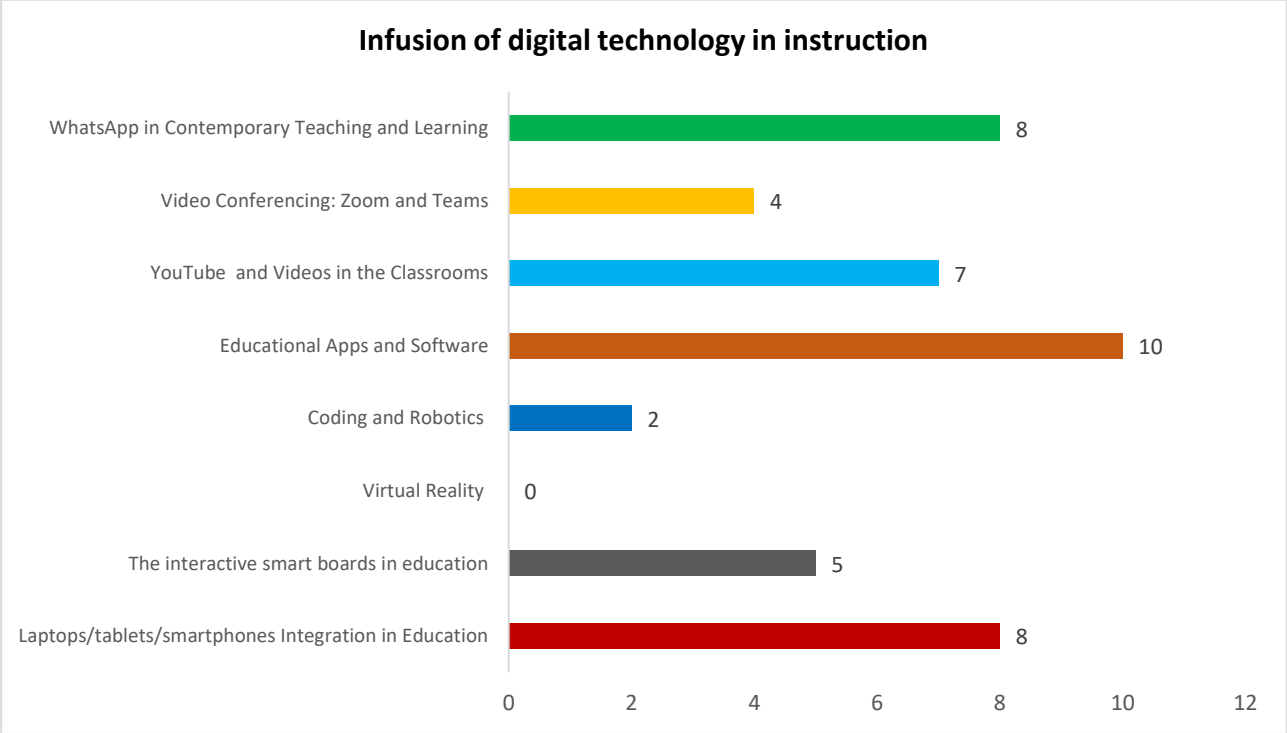

Figure 4 Distribution of digital technology platforms preferred by participants.

The study delineated several prevalent sub-themes evident within the discourse surrounding the integration of technology in the schools. Foremost among these themes is the pervasive utilization of laptops/tablets and interactive smartboards, which serves as primary tools for accessing and engaging with digital educational materials. Additionally, educational software and various online learning platforms, such as WhatsApp, MS Teams, Zoom, YouTube, and video resources, assume a substantial role in delivering and augmenting instructional content. Despite the established integration of these technologies into pedagogical practices, the study illuminates the emergence of incipient sub-themes within this evolving narrative, indicative of burgeoning frontiers endowed with transformative potential. Notably, these nascent themes encompass coding, robotics, and virtual reality (VR). Although presently referenced minimally and consequently underutilized, these platforms harbor considerable promise for reshaping the educational landscape.

5.4.1 Laptops/tablets/smartphones integration in education

The study categorized schools into two distinct groups: those designated as ICT schools and those classified as non-ICT schools. ICT schools are equipped with essential technological resources such as laptops, smartboards, and tablets, either provided by the educational institution or through external funding sources. Conversely, non-ICT schools rely on their internal budget allocations to procure such resources, often resulting in limited access to technological amenities for educators and learners alike. For instance, in the suburb ICT school, while grade 7 educators were provided with laptops, smartboards, and tablets by the Department of Education, efforts were made by the school administration to ensure equitable distribution of laptops and smartboards across all grade levels. In contrast, the township ICT school primarily received technological resources for grade 7

learners and educators, leaving other grades reliant on traditional teaching methods due to resource constraints.

Conversely, non-ICT schools face significant challenges in providing adequate technological resources. For instance, the suburb non-ICT school managed to procure a limited number of laptops and projectors; however, the insufficient ratio of devices to educators (1:6), coupled with the logistical challenges of loaning devices from the school office and setting them up in overcrowded classrooms, presents significant obstacles. Furthermore, not all educators possess the technical skills necessary to effectively utilize these devices, further hindering their integration into teaching practices. The township non-ICT schools highlight the disparities in our schools with the complete absence of dedicated ICT resources for educators which starkly underscores the pervasive challenges and exacerbates existing educational inequalities. While managers and administrators have access to laptops, this limited provision further highlights the systemic exclusion of frontline educators who play a crucial role in shaping learner learning experiences.

Despite these challenges, the integration of laptops and tablets in the classroom has demonstrated numerous benefits for both educators and learners. Recent studies by Johnson et al. (2023) and Smith et al. (2023) highlight the transformative impact of these devices on learner engagement, digital literacy, and instructional diversity. Specifically, laptops and tablets facilitate personalized learning experiences, access to a vast array of educational resources, and the development of critical digital literacy skills. Educators can leverage these devices to create dynamic and interactive lessons, fostering collaborative learning environments that cater to diverse learning styles.

Moreover, the seamless integration of technology enables real-time feedback and assessment, enhancing educators' ability to tailor instruction to meet the individual needs of learners. Despite the persisting challenges of equitable access and digital distractions (Hesse et al., 2022) the overall consensus among participants from ICT schools underscores the essential role of laptops and tablets in facilitating effective ICT integration within educational settings. These devices are perceived as indispensable tools that not only enhance teaching and learning experience but also equip learners with essential skills for success in a digitally driven world.
While once primarily viewed as distractions, smartphones are rapidly evolving into potent pedagogical tools, fundamentally reshaping the landscape of teaching and learning. This ubiquitous technology, readily accessible to many, presents a unique opportunity to enhance educational experiences by fostering engagement, collaboration, and accessibility. Educators can leverage smartphones to ignite learner interest through captivating content. Educational apps, interactive simulations, and multimedia resources, catering to diverse learning styles, transform

passive information consumption into active exploration and discovery (UNESCO, 2017). Smartphones, moreover, act as bridges, facilitating seamless communication and collaboration between learners. Shared documents, multimedia presentations, and virtual discussions transcending classroom walls allow for dynamic group projects and peer-to-peer learning (Sánchez et al., 2018). This flexibility empowers learners to learn anytime, anywhere, breaking down geographical barriers and democratizing access to knowledge.

However, this technological revolution necessitates a cautious approach. Digital divides remain a real concern, potentially exacerbating educational inequalities (Hwang et al., 2019). Additionally, the allure of distractions and potential misuse necessitate thoughtful integration strategies. Clear boundaries, responsible digital citizenship education, and innovative pedagogical approaches that encourage purposeful technology use are key to harnessing the full potential of smartphones in the classroom (Liaw, 2008). The integration of smartphones in education marks a paradigm shift, offering new avenues for engagement, collaboration, and accessibility. By proactively addressing challenges and adopting innovative pedagogies, educators can be empowered to leverage these ubiquitous devices, transforming classrooms into vibrant hubs of interactive learning, and ensuring that no learner is left behind in the digital age. However, their successful integration requires addressing digital divides and promoting responsible digital citizenship to unlock the full benefits of this technological revolution.

5.4.2 The interactive smart boards in education

Interactive Smart Boards, also known as Interactive Whiteboards (IWB), represent a technological advancement in educational settings, aiming to enhance teaching and learning experiences by replacing static projectors with a dynamic touchscreen interface. These boards, resembling giant wall-mounted tablets, consist of a large touch-sensitive display connected to a computer, enabling educators to manipulate digital content, run applications, and engage learners in real-time. The value of teaching with Smart Boards lies in their capacity to create interactive and dynamic learning environments, fostering collaboration and transforming learners into active participants (UNESCO, 2023). Features such as touch control, multimedia integration, and collaborative functionalities contribute to the creation of engaging lessons. Visual and interactive elements cater to diverse learning styles, benefiting visual and kinesthetic learners alike. Furthermore, the incorporation of gamified elements adds an extra dimension to the learning experience.

Globally, the adoption of Interactive Smart Boards in education has been substantial, particularly in developed nations like Singapore, Finland, and South Korea, where these boards have become integral to classrooms (Lim et al., 2018; Marrone et al., 2021; Tinmaz & Ozturk, 2019). However, South Africa's experience has been more nuanced, with progress in urban schools but challenges, including infrastructure limitations and resource disparities, affecting widespread implementation,

especially in socio-economically disadvantaged communities. Additionally, marginalization between schools (ICT and non-ICT) in the provision of resources further exacerbates this digital divide. The ongoing debate surrounding ICT vs. non-ICT approaches is evident, with Smart Boards offering personalized learning experiences, access to online resources, and improved communication, while concerns about digital divides and the importance of foundational teaching methodologies persist (Zhao, 2015; Adams, 2019; Warschauer, 2017; Leiberman, 2015). Despite having access to technological devices, participants from ICT schools acknowledged minimal utilization due to their limited understanding of the functionalities and potential capabilities of these tools. Consequently, these devices are primarily utilized for basic tasks such as delivering lessons to learners, without exploring their full range of possibilities.

The global trend towards incorporating technology into education necessitates a balanced approach that acknowledges both the advantages of ICT tools like Smart Boards and the indispensable role of strong pedagogy and human interaction in the learning process (ITU, 2022; Cuban, 2013). Achieving this balance requires careful consideration of factors such as infrastructure, educator training, and curriculum development. While embracing interactive technologies like Smart Boards has the potential to enhance learning, safeguarding the essential elements of quality education remains paramount.

Interactive Smart Boards have become integral tools in modern education, offering immersive learning experiences. The global adoption underscores their significance yet challenges in countries like South Africa emphasize the need for a thoughtful approach to ensure equitable access and effective implementation. Striking the right balance between ICT and non-ICT methods is crucial, acknowledging that the successful implementation of Smart Boards lies not just in the technology itself but in its integration within a comprehensive educational framework. When used alongside strong pedagogy and proper educator training, Smart Boards can be a powerful tool for enhancing learning outcomes, if efforts address existing digital divides and ensure equitable access to technology in South Africa's education system.

5.4.3 Educational Apps and Software

Educational apps and software have revolutionized learning, transcending the limitations of physical classrooms and traditional textbooks. Despite the vast potential of digital tools to revolutionize education, this study reveals a disconnect between their capabilities and their actual classroom utilization. While tools like gamified learning platforms offer engaging experiences and democratize access to knowledge (UNESCO, 2023), from making abstract concepts fun (Kebrit et al., 2022) to immersive simulations (Bakhshi et al., 2017), the reality in this context paints a different picture.

Participants primarily rely on basic Microsoft Office applications, exhibiting limited proficiency beyond administrative tasks. This highlights a gap in pedagogical ICT integration, where technology serves a mundane purpose rather than enriching instruction. Even with basic tools like internet navigation and email, limited utilization suggests a rudimentary level of digital literacy. This emphasizes the need for targeted educator training programs to equip educators with skills for integrating educational apps and software effectively.

There are vast possibilities of these educational apps that actively engage learners through interactive quizzes, collaborative projects, and adaptive learning algorithms that personalize content to individual needs (Chiu & Cheng, 2020). This adaptive approach caters to diverse learning styles and paces, empowering learners to learn at their own speed and maximize their potential (Adams, 2019). Additionally, these tools offer valuable data insights for educators, allowing them to track learner progress and tailor instruction, accordingly, fostering a more responsive and effective learning environment (Leiberman, 2015).

However, challenges remain in harnessing the full potential of educational apps and software. Digital divides and inequitable access to technology can exacerbate existing educational inequalities (Mioduser, 2019). Concerns about screen time, potential distractions, and the quality of educational content also necessitate careful consideration and responsible implementation (West, 2012). Furthermore, educators need to be equipped with the skills and knowledge to effectively integrate these tools into their teaching practices, ensuring they complement, rather than replace, traditional pedagogical approaches (Cuban, 2013). Despite these challenges, the potential of educational apps and software is undeniable. By addressing accessibility issues, promoting responsible digital citizenship, and providing robust educator training, we can unlock the transformative power of these tools for all learners. In doing so, we can create a future where learning is no longer confined by physical walls or traditional methods, but becomes a dynamic, personalized, and accessible experience for everyone.

5.4.4 WhatsApp in contemporary teaching and learning

Transcending its ubiquitous presence in social communication, WhatsApp is emerging as a transformative tool in contemporary teaching and learning, offering unique benefits for bridging the gap between educators and learners in geographically dispersed settings (Akpan & Ezinne, 2017). This accessibility stems from its user-friendly interface and widespread adoption by learners, fostering immediate two-way communication and asynchronous discussions through group chats dedicated to specific courses or activities (Ujakpa, Heukelman, Lazarus, Neiss, & Rukanda, 2018; Yilmaz-Soylu & Akkoyunlu., 2008). This fosters a sense of community and active engagement, empowering learners to ask questions, share resources, and collaborate on

projects beyond the confines of traditional classrooms (Bers et al., 2014). Furthermore, WhatsApp's multimedia capabilities unlock new avenues for knowledge dissemination. Educators can share diverse learning materials, including images, videos, and voice notes, catering to various learning styles, and enhancing knowledge retention (Cabual, 2021). The platform's flexibility allows for quick distribution of homework assignments, feedback, and study resources, promoting learner autonomy and personalized learning experiences (Liton, 2021). Additionally, WhatsApp groups can function as virtual study spaces, encouraging peer-to-peer interaction and collaborative learning beyond the traditional classroom setting (Ibrahim, 2023; Tunjera, 2023).

However, challenges remain in harnessing the full potential of WhatsApp for educational purposes. Concerns regarding privacy, data security, and potential misuse necessitate careful consideration and responsible digital citizenship practices (Voogt et al., 2013). Bridging the digital divide by ensuring equitable access to technology and internet connectivity for all learners is crucial to avoid exacerbating existing educational inequalities (Correia, 2020).

Several participants in this study, disclosing their utilization of WhatsApp, affirmed its sole application for communication with parents regarding school-related activities and homework reminders, explicitly excluding its use for instructional purposes. Conversely, other educators cited aversion to such communication platforms due to challenges arising from frequent parental grievances on trivial matters, resulting in frustration among educators. Despite the availability of these platforms, their efficacy in educational contexts appears limited. Patty and Bilung (2023) contend that educators necessitate pedagogical proficiency to seamlessly integrate WhatsApp into lesson plans and assessment strategies, underscoring the imperative for comprehensive training initiatives. Such training is indispensable, as not all educators possess innate familiarity with these platforms, and it must be recognized that not all learners have equitable access to ICT resources and data at home, potentially impeding their participation in such activities. Despite these challenges, the potential of WhatsApp to transform teaching and learning is undeniable. By addressing security concerns, promoting responsible digital citizenship, and equipping educators with necessary pedagogical skills, we can unlock the platform's power to create engaging, collaborative, and inclusive learning environments for all learners in the digital age.

5.4.5 Video Conferencing: Zoom and Teams

The integration of collaborative communication platforms such as Microsoft Teams and Zoom presents multifaceted possibilities for the pedagogical integration of ICTs within educational contexts. Microsoft Teams, renowned for its real-time video conferencing, document sharing, and breakout room functionalities, has been lauded for fostering interactive and collaborative learning environments (Lee & Park, 2023). Research underscores its efficacy across various pedagogical

approaches, including flipped classrooms, project-based learning, and peer tutoring (Liu et al., 2022), with its integration with other Microsoft Office applications further enhancing its utility for educational purposes (Hussain & Al-Douri, 2023). Several participants disclosed their utilization of MS Teams primarily for attending meetings convened by department officials. Despite this usage, they expressed a lack of familiarity with the platform's diverse functionalities and educational affordances, often resorting to minimal engagement by merely clicking on provided links to join meetings via their cellphones. Moreover, participants voiced concerns regarding their inadequate proficiency in arranging meetings on the platform, compounded by challenges stemming from unreliable internet connectivity. They emphasized the necessity for training to leverage MS Teams for educational purposes effectively. Concurrently, issues such as limited accessibility for learners lacking necessary devices or stable internet connections (Kizilcec & Özer, 2023), apprehensions surrounding data privacy, and the potential inclination towards educator-centered instructional methods (Mohammadi & Mohammadi, 2021) underscored the imperative for comprehensive professional development initiatives. These initiatives should equip educators with the requisite pedagogical skills to navigate the platform proficiently (Hussain & Al-Douri, 2023). Despite the potential of Microsoft Teams to augment ICT integration within educational settings, addressing challenges related to accessibility, privacy concerns, pedagogical approaches, and educator training is paramount to optimize its efficacy and ensure equitable access to its benefits for all learners.

The surge in remote and online education has propelled video conferencing platforms such as Zoom to the forefront of contemporary teaching and learning methodologies. Zoom's intuitive interface and versatile features facilitate real-time communication, collaboration, and content sharing, effectively emulating traditional classroom dynamics within virtual environments (Berutu & Hanana, 2023; Mhlanga & Moloi, 2020). Participants from the suburb ICT school highlighted their utilization of Zoom lessons across classes in each grade to ensure standardisation and continuity of instruction in the absence of educators. However, the predominant use of one-way presentations in these lessons impedes interactivity and engagement, leading to discipline challenges and a lack of opportunities for learner clarification (Berutu & Hanana, 2023; Mhlanga & Moloi, 2020). Despite its potential for interactive lectures, discussions, and multimedia integration, zoom faces challenges such as digital fatigue resulting from prolonged screen exposure and the absence of physical interaction (Stefanile, 2020). Additionally, concerns regarding privacy and the equitable distribution of technology and dependable internet connectivity persistently loom, posing significant threats to exacerbating educational inequalities (Kagan et al., 2020; Lembani et al., 2020). Participants expressed their frustration and sense of disorientation when confronted with challenges related to internet connectivity and power outages. To counteract these obstacles, educators must deploy strategic pedagogical interventions aimed at

alleviating digital fatigue while cultivating inclusive virtual learning environments conducive to active engagement and community-building (Stefanile, 2020; Kagan et al., 2020). Furthermore, robust research and the development of innovative pedagogical strategies are essential to unlocking the full potential of platforms like Zoom and ensuring their effective and equitable implementation in fostering inclusive and engaging educational experiences. This necessitates a multifaceted approach encompassing digital access, diverse teaching methods, data privacy, and security, as well as comprehensive training and support for educators to integrate these tools effectively into their pedagogical practices. Through ongoing research and collaboration, the transformative potential of technology in creating inclusive learning environments tailored to the needs of all learners in the digital age can be realized.

Moreover, insights from participant perspectives shed light on the varied utilization and challenges associated with platforms such as Zoom and Microsoft Teams within diverse educational settings. While some schools employ synchronous Zoom lessons across grade levels to mitigate educator absence and ensure continuity, passive engagement and limited interactivity characterize these sessions. Meanwhile, participants from township ICT schools highlight disparities in educator familiarity and utilization of such platforms, indicative of the need for targeted training initiatives. Additionally, challenges including internet connectivity issues, power outages, and technical glitches pose persistent obstacles to seamless platform utilization, underscoring the importance of addressing infrastructural barriers to equitable digital access. Overall, these findings underscore the multifaceted nature of platform integration within educational contexts and emphasize the importance of comprehensive support structures to optimize their potential for enhancing teaching and learning outcomes.

5.4.6 YouTube and Videos in the Classrooms

Once perceived solely as a platform for entertainment, YouTube is increasingly finding its way into the hallowed halls of education. This ubiquitous video-sharing platform, with its vast library of engaging and informative content, is transforming the learning landscape by offering unique benefits for both educators and learners (Chang et al., 2022). Educators who integrate technology into their instructional practices underscored a recurrent reliance on YouTube as a valuable resource, noting its capacity to furnish a wealth of readily accessible materials to augment the often-inadequate content resources available within their educational environments. This sentiment finds resonance in the findings of Yusoff et al. (2020), who similarly advocate for the utilization of educational channels on the platform. These channels are recognized for their provision of meticulously curated video lessons spanning a broad spectrum of subjects, thereby serving to complement traditional instructional materials and enhance the efficacy of curriculum delivery methodologies. From captivating science experiments to virtual field trips to historical

reenactments, YouTube videos bring abstract concepts to life, promoting deeper understanding and learner engagement (UNESCO, 2023). Additionally, educators can leverage YouTube's customizable features to create their own video lectures, tutorials, and flipped classroom content, catering to diverse learning styles, and fostering independent learning (Chiu & Cheng, 2020).

For learners, YouTube offers a personalized and accessible learning experience. The platform's vast and diverse content library caters to individual interests and learning styles, allowing learners to explore topics beyond the limitations of the textbook or curriculum (Chen & Hung, 2021). This self-directed learning empowers learners to take ownership of their education and fosters a love for lifelong learning (UNESCO, 2023). Additionally, YouTube's interactive features, such as comments and annotations, create a virtual community where learners can connect with peers, share insights, and engage in collaborative learning (Chiu & Cheng, 2020). However, integrating YouTube into education necessitates careful consideration. Concerns about misinformation, inappropriate content, and attention distractions require vigilant curation and responsible digital citizenship education (West, 2012). Furthermore, equitable access to technology and internet connectivity remains a challenge, potentially exacerbating educational inequalities (Mioduser, 2019). Despite these challenges, the potential of YouTube in education is undeniable. By addressing accessibility issues, promoting responsible digital citizenship, and adopting thoughtful video integration strategies, we can unlock the platform's immense potential to democratize knowledge, engage learners, and transform learning experiences for the better.

5.4.7 Coding and Robotics

Educational robots and coding kits are not just toys; they are transformative tools bridging the gap between abstract concepts and tangible experiences in the classroom. These interactive companions introduce learners to the fascinating worlds of robotics and coding, fostering crucial 21st-century skills like computational thinking, problem-solving, and creativity (Bers et al., 2014). Codng and Robotics offer a range of possibilities for learners to build and programme robots and to navigate mazes, solve challenges, or even collaborate on complex tasks. These engaging activities make abstract coding concepts like loops, conditionals, and sequences come alive, igniting a passion for STEM subjects (Yilmaz-Soylu et al., 2014). While glimpses of potential emerged within the ICT school, the implementation of coding and robotics in the foundation phase (Grade R) remained disappointingly unrealized. Two educators expressed vague awareness of the initiative yet lacked essential training and understanding to utilize the provided kits effectively, rendering them dormant tools. This stark reality was further underscored by participants from other schools who exhibited complete unfamiliarity with these concepts. This missed opportunity presents a significant loss, considering the immense benefits of coding and robotics for young learners. As Koutromanos et al. (2017) highlight, the hands-on nature of these kits caters to

diverse learning styles, allowing visual and kinesthetic learners to flourish alongside their analytical peers. Beyond cognitive development, robotics and coding foster valuable non-cognitive skills. Overcoming challenges and finding solutions to unexpected glitches builds resilience and problem-solving abilities, as emphasized by Alimisis et al. (2018). The collaborative nature of designing, building, and programming robots' further nurtures communication and critical thinking skills, competencies crucial in our interconnected world (Voogt et al., 2013).

Realizing the full potential of coding and robotics within the foundational stages of education necessitates a comprehensive approach. This approach entails the development of robust educator training initiatives equipped with pedagogical methodologies aimed at seamlessly integrating these technological tools into the educational framework. Moreover, rectifying disparities in resource allocation and ensuring universal access to requisite kits and technological infrastructure are imperative. Through the implementation of these strategies, it becomes possible to transcend superficial familiarity and cultivate an enriching learning milieu wherein all young learners are afforded the opportunity to flourish within the digital milieu.

5.4.8 *Virtual Reality*

Virtual reality (VR) headsets are revolutionizing education by transporting learners beyond the limitations of classrooms and textbooks. These immersive devices create virtual environments, allowing learners to explore historical battlefields, dissect virtual frogs, or climb the world's highest mountains, all from the safety and comfort of a classroom (UNESCO, 2023). This experiential learning fosters deeper understanding and engagement, particularly for kinesthetic and visual learners (Adams, 2019). VR headsets offer unique advantages over traditional learning methods. Interactive simulations provide hands-on learning experiences, allowing learners to manipulate objects, conduct experiments, and solve problems in a risk-free environment (Greenfield, 2017). Gamification elements further enhance engagement, motivating learners to explore, discover, and conquer virtual challenges (Deterding, 2011). Additionally, VR breaks down geographical barriers, enabling learners to visit locations previously inaccessible, foster cultural understanding, and collaborate with peers across the globe in real-time (Bakhshi et al., 2017).

Despite the potential of VR to transform educational experiences, significant challenges remain in fostering its widespread adoption. Participants familiar with VR and gamification acknowledged the diverse technological possibilities yet expressed skepticism about classroom implementation. This hesitancy stemmed primarily from lack of skills to integrate these devices in lessons and affordability. Participants expressed concerns regarding the seamless integration of VR into

existing lesson plans and pedagogical frameworks, highlighting the need for development to bridge the gap between VR technology and effective instructional design, providing educators with concrete strategies and resources for leveraging VR's unique capabilities within their teaching practices. This aligns with Cuban's (2013) assertion that effective VR learning demands well-designed content and trained educators to guide learners within immersive environments., Secondly, cost remained a significant barrier for some participants, who perceived VR technology as financially out of reach for their schools, thus necessitating the exploration of cost-effective solutions, such as shared VR experiences, open-source VR resources, and alternative funding models, to ensure equitable access to this potentially transformative technology across diverse educational settings. Sharing the same sentiment, Lieberman (2015) reinforces this, acknowledging cost and equipment compatibility as critical limitations. Additionally, potential side effects and health risks must be carefully considered and responsibly addressed during implementation.

Beyond these specific concerns, the participants' self-reported lack of motivation to explore VR further suggests wider issues around awareness, training, and professional development opportunities. Equipping educators with the necessary knowledge, skills, and confidence to experiment with VR and integrate it effectively into their teaching repertoires is crucial for overcoming these barriers.

Despite these challenges, the potential of VR headsets in education is undeniable. By harnessing their immersive power and integrating them thoughtfully within a comprehensive educational framework, we can create vibrant learning environments where learners become active participants in their own education. Through exploration, experimentation, and collaboration, VR has the potential to unlock a new era of learning, one where classrooms truly become gateways to boundless possibilities.

Nevertheless, obstacles persist in the integration of these tools into educational settings. Financial constraints and limited access to resources pose considerable impediments, potentially exacerbating disparities in educational attainment (Mioduser, 2019). Furthermore, the effective deployment of these tools necessitates educators' adeptness in imparting the requisite skills and knowledge to guide learners confidently through novel learning modalities (Brenner & Resnick, 2012). Despite these challenges, the transformative potential of educational robotics and coding kits remains incontrovertible. Through concerted efforts aimed at addressing accessibility concerns and bolstering educator training initiatives, the transformative potency of these tools can be fully harnessed for the benefit of all learners. In so doing, the forthcoming generation can be

empowered as innovators, critical thinkers, and adept problem-solvers, equipped with the skill set and creativity requisite for navigating the ever-evolving technological landscape of the future.

5.5 Theme 2: Barriers to ICT integration in the classroom

Despite South Africa's commendable efforts to integrate ICT into classrooms, educators face persistent challenges that hinder them from fully leveraging its potential to enhance the learning experience. These obstacles are reflective of enduring issues encountered in global education. Within the current educational landscape, the integration of ICTs has become a crucial component, fundamentally shaping the dissemination and acquisition of knowledge. As educational institutions endeavor to exploit the capabilities of digital tools for improving teaching and learning, numerous challenges arise, necessitating thorough scrutiny. This paper undertakes a comprehensive exploration of the intricate domain of ICT integration in education, concentrating on various critical sub-themes that exert a substantial impact on the success or impediment of such initiatives.

The subsequent section engages in a comprehensive analysis of key sub-themes, each integral to determining the efficacy of ICT integration in educational settings. Inadequate ICT resources, spanning hardware, software, and infrastructure, present persistent challenges for institutions, impacting the overall integration process and posing obstacles for educators and learners. Ambiguous ICT policies, imperative for successful integration, can lead to confusion among stakeholders, hindering the seamless adoption of technology in education. The coexistence of educators from different generations, characterized by varying digital literacy levels, introduces challenges explored in the dynamics between the "Net Generation" and traditional educators, impacting the successful incorporation of ICT in teaching methodologies. Technical support emerges as a cornerstone for ensuring the smooth functioning of ICT tools, with a focus on addressing challenges faced by educators and the role of support mechanisms in overcoming hurdles. Financial constraints, playing a pivotal role in determining institutional investments in ICT infrastructure, are examined to understand how budgetary limitations impact the integration and sustainability of effective ICT practices. Leadership within educational institutions plays a crucial role in steering ICT integration, with an exploration of the impact of leadership styles and the importance of continuous professional development for educators to stay abreast of technological advancements.

Table 4 illustrates a synopsis of the barriers articulated by participants within this study concerning their implementation of pedagogical integration of ICTs within their schools. These barriers are exemplified within diverse sub- themes.

Barriers to ICT integration in the classroom	Participants

Inadequate ICT resources	10
Ambiguous ICT policies	6
Net Generation versus Old Guard educators	8
Technical Support	10
Financial Constraint	7
Leadership	8
Professional Development	16

Table 4 Barriers encountered by participants in the integration of ICTs in their educational setting.

The overview delineated in Table 4 is visually depicted in Figure 5, accentuating, and mirroring the impediments encountered in the practical implementation of ICT integration at the grassroots level, representing the various sub- themes. The data represents the number of participants who expressed their challenges experienced within each sub- theme.

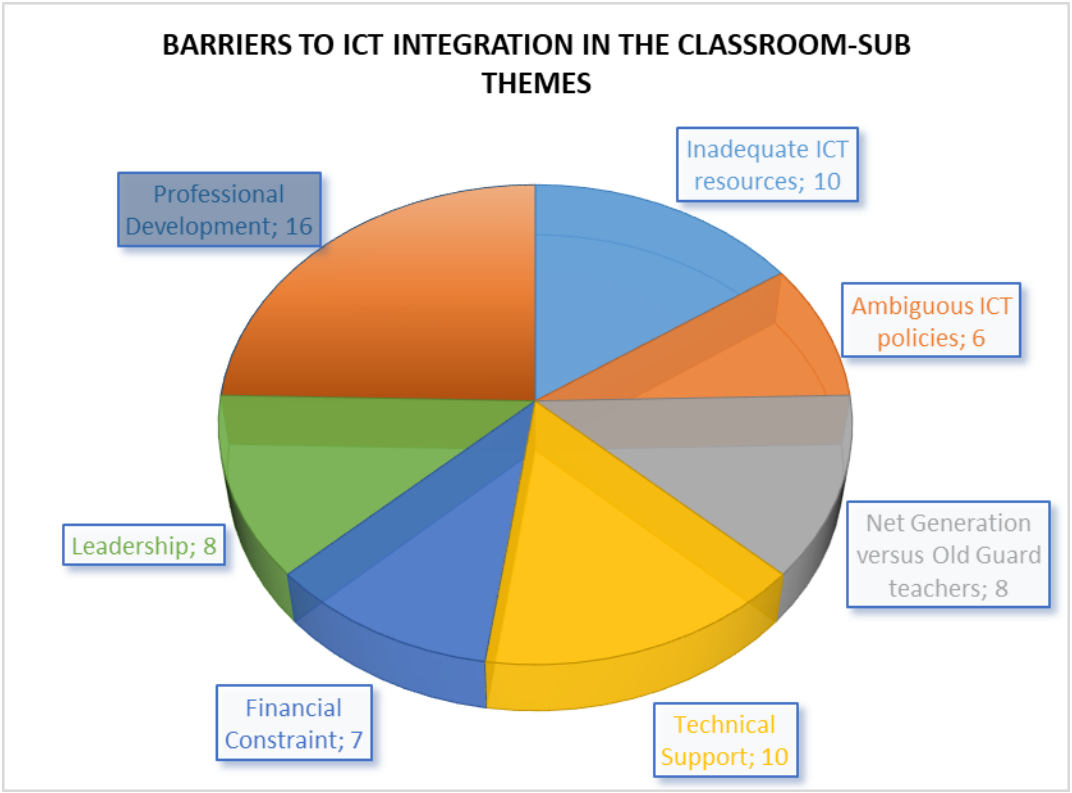

Figure 5 Graphical representation of sub-themes pertaining to barriers in ICT integration

Recognizing the interconnectedness of these sub-themes is essential, as they collectively weave an intricate web in the context of ICT integration in education. Through dissecting these challenges, this paper aims to contribute to a nuanced understanding of the intricacies surrounding the adoption of technology in educational settings.

5.5.1 Inadequate ICT resources

In South African classrooms, the absence of robust ICT resources is not just a technological hiccup; it is a persistent cloud obscuring the true potential of both teaching and learning. The participants' reflections painted a concerning picture of a patchwork landscape when it comes to ICT access in South African schools. A stark digital divide separates schools, with resources concentrated in pockets while leaving others lagging. In some fortunate schools, primarily those designated as "ICT schools," although concerns persist, a discernible trajectory towards improvement warrants cautious optimism. In the suburb ICT- schools, Grade 7 educators and learners were provided with laptops and tablets respectively, these classrooms were also provided with mounted interactive smartboards. The grade seven classrooms, educators and learners' devices were provided by the Gauteng Department of Education (GDE). The suburb ICT school had also strived to ensure that all other classrooms were equipped with an interactive smartboard. Through various forms of donations, laptops were provided to educators. However, the quality of available resources paints another layer of frustration as all educators (both grade 7 and other) are trying hard to manage with these aging laptops that have not been updated nor maintained in the last seven years. This is frustrating to use outdated machines, coupled with unreliable connections, and a lack of essential software which often plague even those fortunate enough to have hardware (Moletsane & Venter, 2018). Yet, these devices, though outdated and barely functional, represent a precious link to the digital world, offering a taste of the possibilities that lie beyond traditional textbooks since the Smartboards provide a flickering screen that displays archaic educational software (Matemera, 2020). The township ICT-schools, on the other hand, only the grade 7 educators, learners and their classrooms were provided with laptops, tablets, and a smartboard, whilst all other grades were completely disadvantaged from ICT devices. Non-fee-paying schools were unable to provide resources such as laptops and tablets for the educators in the other grades. Suburb non-ICT schools are not any better, since resource scarcity still reigns. Insufficient Laptops are shared amongst educators (6 mobile laptops and projectors are available and shared to 38 educators). The scope of available resources falls short of addressing the requirements of a substantial number of educators. The limitations stretch beyond mere quantity. The harshest reality unfolds in township non-ICT schools. At these schools, computing devices are a mirage, reserved solely for the administrative staff and school management team. Both educators and learners yearn for a touch of the technology they glimpse in other schools, their classrooms eerily silent in the absence of the hum of digital learning. The reality of ICT resource deprivation takes

away the dynamism of modern learning, further dampening the excitement for embracing technology in the classroom. (Sithomola, 2021).

This stark digital divide not only hinders progress but also widens educational inequalities (Evans & Ng'ambi, 2022), leaving many learners yearning for the opportunities denied to them. According to (Sithamola, 2021), South Africa's stark socio-economic inequalities, exacerbated by a profound digital divide, are actively undermining the possibility of using digital tools in an era where it is prevalent. This highlights the urgent need to bridge this digital gap to ensure all South Africans can participate in an educational terrain driven by advanced technologies.

The participants commented that the ICT resource scarcity stifles creativity and engagement, trapping learners in a cycle of passive learning. In addition, this scarcity of ICT resources denies learners the chance to explore, experiment, and connect with information online. Participants further indicated that learners' natural curiosity remains tethered to the confines of traditional methods. As Ally and Park (2022) argue, for learners navigating educational landscapes characterized by resource scarcity, pedagogical innovations aimed at fostering engagement and personalization; interactive exercises, feedback loops, and collaborative projects; exist primarily as theoretical constructs. The disconnect between the promise and reality of modern education transforms the ideal of learning as a journey of discovery into a dispiriting routine. The consequences of this digital divide reach far beyond the learners. Educators, brimming with ideas for ICT-driven lessons, are forced to abandon their aspirations due to lack of resources. This leads to frustration and a sense of futility, impacting their morale and effectiveness (Evans & Ng'ambi, 2022). This not only impacts individual educational trajectories but also perpetuates societal inequalities as technology becomes increasingly essential for success (Evans & Ng'ambi, 2022).

5.5.2 Ambiguous ICT policies

South Africa has recognized the transformative potential of ICT in the realm of education. In recent years, the government has implemented a range of policies aimed at integrating ICT into the educational system. This section provides a comprehensive overview of what participants mentioned about ICT integration policies in education, objectives, challenges, and the impact on teaching and learning. While South Africa's ICT integration policies showcase ambitious visions, educator awareness remains a crucial bottleneck. Participants in this study, particularly principals and school managers revealed that they have heard of the 2004 White Paper on e-Education, however, they are not aware of the content and how it should be implemented. In addition, they have never heard any of the ICT policy that talks about ICT integration in the classrooms. Many educators seem to not be aware of the 2004 White Paper on e-Education, however, the ones integrating ICT in teaching and learning stem from their own initiative and exposure in the use of

digital tools. This on its own create unevenness as some educators particularly those of old generation are hesitant in embracing this tool due to lack of skill and technophobia. Some of the managers in this study expressed skepticism about ICT policies because of the ambiguity. They mentioned that ICT policies are generic and that they are not relevant to their contexts, hence not taking any interest in implementing such policies. Other managers in this study indicated that they have heard about such a policy but were not exposed to it, therefore they were not able to comment explicitly about the policy. Addressing this awareness gap through targeted information dissemination, context-specific training, and fostering a culture of knowledge exchange among educators are essential steps towards realizing the full potential of ICT integration in South African schools (Munje P & Jita, 2020).The educators on other hand, also responded similarly to the managers, expressing that they were not ready to implement the ICT policy in the classroom as they were not aware of the content of the policy which they have limited knowledge about. While workshops and training programs on ICT implementations existed sporadically, their reach and effectiveness varied, leading to inconsistencies in ICT implementation across schools (Padayachee, 2017). This lack of awareness led to confusion, hesitancy, and missed opportunities for technology-driven learning.

The chasm between ambitious policy aspirations and the lived realities of schools frustrates effective ICT integration in South Africa. The participants, comprising both school leaders and educators, echoed Padayachee's (2017) concerns, expressing discouragement due to resource limitations and inadequate training and support. While acknowledging the importance of technology in the "digital era," participants lamented the gap between policy pronouncements and their ability to implement them. This disparity in understanding what constitutes meaningful ICT integration, as evidenced by individual interpretations among respondents, further highlights the lack of clarity in policy expectations. Notably, resource constraints and infrastructure limitations, as Padayachee (2017) argues, are often overlooked in overly ambitious policy frameworks, perpetuating a disconnect between policy promises and on-the-ground realities. This disconnects not only fuels frustration but also impedes effective implementation, ultimately hindering the transformative potential of ICT in fostering equitable and empowered learning experiences for South African learners. Thus, the studies by Dlamini & Dewa (2021) recommend that the ICT policy should address the disparities of the uneven access to educational digital tools and infrastructure and should know neither the culture nor social status of the school.

South Africa's ambitious ICT integration policies have ignited hope for a technology-driven educational revolution. But how far have these aspirations translated into tangible progress? This section delves into the realities of implementation, examining successes, challenges, and the road ahead. Initial strides have been encouraging. The National ICT in Education Policy (2004) laid a

sturdy foundation, with subsequent frameworks like the 2014 Strategy and the 2021 "Enhancing ICT Readiness" refining the roadmap. Infrastructure development has seen growth, with internet connectivity reaching over 90% of schools by 2021 (Department of Basic Education, 2021). Initiatives like the National School Net and Vodacom's "ConnectEd" program have further fueled connectivity expansion (Magoro, K., Abrahams, L., Burke, M., Magoro, N., Masonta, M., Milne, C., & Shilenge, R, 2023).

Despite concerted efforts to integrate ICT into South African schools, the journey towards transformative education remains fraught with challenges. Notably, persistent digital divides exacerbate disparities between schools, leading to unequal access to infrastructure and resources (Du Preez & Le Grange, 2020). This uneven landscape is compounded by widespread dissatisfaction among participants regarding the implementation of ICT policy. A core concern revolves around educator training, a critical pillar often marred by inadequate provisions. Participants lament the subpar quality of ICT training they receive, rendering its application in the classroom problematic. Short and intensive workshops, perceived as overwhelming and ineffective, leave educators with challenges to grasp key concepts. While the provision of such training marks a step towards progress, resource constraints and inconsistencies in program quality continue to be major hurdles (Meladi & Awolusi, 2019). Further anxieties surround the quality and relevance of digital content. Calls for context-specific curriculum integration and culturally appropriate materials highlight the need for resources that resonate with diverse learners and their lived experiences (Ngqondi & Mauwa, 2019). Addressing these concerns requires a nuanced approach that acknowledges local contexts, celebrates cultural identities, and ensures equitable access to high-quality ICT experiences. While South Africa's progress in implementing ICT policies represents a commendable effort, bridging the persistent implementation gap necessitates a critical reevaluation. Addressing digital divides, enhancing educator training, and prioritizing contextually relevant digital content are key steps towards ensuring that the transformative promise of ICT reaches all learners, regardless of their background or location.

Recognizing these hurdles, policymakers are adjusting their trajectory. The "Enhancing ICT Readiness" framework, with its five-level assessment system, encourages targeted interventions based on schools' specific needs. This shift towards data-driven improvement holds promise for a more effective utilization of resources. Additionally, increased emphasis on educator training through collaborations with universities and private sector partners offers hope for upskilling educators (Department of Basic Education, 2021). While progress is evident, achieving the vision of seamless ICT integration demands sustained effort. Addressing funding disparities, prioritizing quality educator training, and fostering innovation in digital content remain crucial. Ongoing monitoring and evaluation, coupled with stakeholder collaboration, is vital in navigating the

remaining turbulence. South Africa's ICT integration journey is still in flight, facing challenges but propelled by promising advancements. By refining implementation strategies, focusing on critical areas like educator training and content development, and maintaining a course correction mindset, South Africa can steer its education system towards a future where technology empowers every learner to soar.

Despite boasting progressive ICT integration frameworks, South Africa's educational landscape still grapples with significant challenges in implementing these policies effectively. Some of the key failures of ICT implementation in South Africa as echoed by the participants include digital divide. The digital divide manifests not only between urban and township schools but also within them, as exemplified by the sampled schools in this study. This study's findings, echoing Mhlanga and Moloi (2020), highlight the disparities in ICT access and support. While participants from sampled ICT-focused suburban school boasts having of ICT resources, albeit outdated and insufficient, for all grades, the township ICT school's resources are confined to the sole grade 7, highlighting the crippling effects of poverty and financial constraints. This intra-school divide further marginalizes learners beyond the urban-rural disparity internally within the township school that echoes the broader inequalities across school contexts due to unequal educator access to technology that exacerbates the divide (Mhlanga and Moloi, 2020). On the other hand, the non-ICT suburb school, despite providing educator devices, still grapples with an insufficient educator-to-device ratio. The stark contrast with the township non-ICT school, where laptops are restricted to administrators and senior management, reflects a concerning trend of limited technology access for educators, reinforcing the notion that technology serves administrative purposes rather than pedagogical ones. This unequal distribution of resources exacerbates the digital divide, impeding learner access to the potential benefits of ICT integration and furthering their exclusion from the technology-driven learning landscape (Global Human Rights Clinic, 2020). Over and above the digital divide constraints, the issue of educator training towards ICT use remains a burning issue.

The sustainability of ICT integration initiatives in South African schools remains a pressing concern. Tigere and Netshitangani (2022) highlight several vulnerabilities, including fluctuating funding due to uneven socio-cultural communities where the learners are coming from, insufficient infrastructure maintenance, and the absence of robust monitoring and evaluation systems. These factors hinder the long-term viability of programs and impede effective progress assessment. School managers in ICT-focused schools, while acknowledging resource availability, confessed the arduous task of ensuring consistent ICT integration among all educators. This lack of guaranteed utilization, despite resources, points to potential gaps in motivation and support structures. Notably, non-ICT schools, constrained by limited resources, lack the leverage to enforce ICT use. The suburb ICT school manager's observation further underscores the issue of

educator disinterest in the absence of mandatory integration. This, coupled with existing challenges in ICT provision, paints a precarious picture of program sustainability and highlights the need for strategies to cultivate intrinsic educator motivation and build robust support systems for long-term success.

South Africa's journey towards seamless ICT integration in education is a tale of both soaring aspirations and turbulent realities. While significant progress has been made, bridging the digital divide, upskilling educators, and developing context-appropriate content remain crucial challenges (Seadira, 2019). Yet, the success stories and the ongoing policy refinements reveal a commitment to harnessing technology's transformative power for educational equity and excellence. By staying true to the course correction mindset, South Africa can ensure that its ICT integration policies truly take flight, empowering every learner to navigate the skies of innovation and success.

5.5.3 Net Generation versus Old Guard educators

The landscape of education has undergone a seismic shift, driven in part by the rise of the "net generation" where acknowledge educators who are born and raised amidst the digital revolution. This new breed of educators brings a unique perspective to the table when it comes to integrating ICTs into primary school classrooms (Tallvid, 2016). Net generation educators possess an inherent familiarity and comfort with technology. They grew up navigating the complexities of the digital world, from social media to coding. The participants at both the township and Suburb schools had highlighted that most of the younger educators at their school attempt to use technologies in their teaching, especially those that are in the non-ICT schools were resources are either limited or are not available, the younger educators use their own resources to present lessons. Most of the younger educators from the ICT schools where resources were provided indicated that they use the Smartboard and tablets regularly. This inherent fluency translates into classrooms where technology is not an add-on, but an organic extension of the learning process (Geeraerts, K., Vanhoof, J., & Van den Bossche, P, 2018). They instinctively grasp the potential of digital tools to personalize learning, foster collaboration, and engage learners in interactive, multimedia experiences.

Educators from pre-digital eras fail to implement ICT integration in their teaching due to a steeper learning curve. While some may embrace the challenge, others might grapple with technophobia or a perceived lack of relevance to traditional teaching methods (Tallvid, 2016). The participants indicated that the experienced educators who are older are reluctant to use technology in their teaching due to lack of confidence, technophobia, limited training, and lack of technical skills. While educators are open to integrating ICT into their classrooms, the lack of robust development opportunities and adequate support structures can hinder effective implementation. Many

educators, particularly those who entered profession before technological era lack foundational technical skills, leaving them vulnerable to technical glitches that disrupt lesson flow and consume valuable time when troubleshooting unfamiliar issues (Dewa, 2022). Persistent glitches deter educators who are excited about using technology in their classrooms, regardless of their experience level. The reluctance is also coupled with the poor infrastructure, limited resources, and load shedding. They are afraid that their lessons will be disrupted. The managers on the other hand, who were mostly of the older generation mentioned that they do not use technology at all for teaching and learning, instead for basic administration as they are not keen due to lack of skills and time constraints to prepare using gadgets. However, experienced educators also contribute much to education because of their deep understanding of pedagogy and child development can be invaluable in ensuring that technology is used effectively and ethically in the classroom. (Geeraerts, K., Vanhoof, J., & Van den Bossche, P, 2018)

Instead of viewing net generation educators and their predecessors as opposing forces, a more productive approach lies in collaboration and knowledge exchange. Net generation educators can provide their tech-savvy expertise and enthusiasm, while experienced educators can offer pedagogical insights and ensure that technology aligns with learning objectives (Barnes, K., Marateo, R. C., & Ferris, S. P, 2007). This synergy can lead to a dynamic and effective ICT integration model that leverages the strengths of both generations.

5.5.4 Technical Support

The efficacy of ICT integration in schools is intricately linked to the provision of technical support, constituting a vital aspect of the educational landscape. Technical support plays a crucial role in facilitating the seamless adoption and sustained use of ICT tools within educational environments. Its impact extends across various dimensions, encompassing hardware and software troubleshooting, network management, and the provision of timely assistance to educators navigating the complexities of digital platforms. In the absence of robust technical support structures, schools may encounter impediments ranging from hardware malfunctions to software glitches, hindering the smooth operation of ICT initiatives (Turgut, Y. E., & Aslan, A, 2021). Moreover, technical support influences educators' confidence and willingness to embrace ICT in their teaching practices (Mirzajani, H., Mahmud, R., Fauzi Mohd Ayub, A., & Wong, S. L, 2016), acting as a catalyst for professional development. The participants at both the schools mentioned that the turnaround time for technical assistance and system upgrade is at least 2-5 days when a call is logged. This turnaround time is frustrating as the lessons planned had to be adapted to blended learning methods that the educators from the Suburb schools are not prepared for. The managers at both Suburb school highlighted that the ICT coordinators at the school attempt to assist with basic repairs but often are unequipped to assist with the major technical challenges.

Due to the technical support being provided by the Department of Education, the wait is long, however, the suburb schools receive help faster as they use private service providers. They mentioned that the financial implications are high, and often they struggle to pay the technicians due to their charges. Participants also mentioned that the lack of prompt technical assistance is frustrating and demotivating. The availability of responsive technical assistance fosters a conducive environment for experimentation, innovation, and the effective utilization of ICT resources. A well-established technical support framework, aligned with the specific needs and challenges of educational institutions, is imperative for realizing the transformative potential of ICT in schools. As schools increasingly rely on digital tools for pedagogical enrichment, the role of technical support emerges as a linchpin, determining the success of ICT integration initiatives and shaping the overall educational experience for both educators and learners.

5.5.5 Financial constraints

In South African schools, financial constraints pose significant challenges to the seamless integration of ICTs into the education system. Operating within tight budgetary constraints, schools face limited funds allocated for ICT integration, hindering the necessary investment in hardware, software, and infrastructure. The upfront costs associated with acquiring ICT resources are often prohibitively high, making it challenging for schools to initiate timely, provide adequate resources and optimal implementation of ICT initiatives (Munje & Jita, 2020; Ramorola, 2013). Participants in Suburb ICT school indicated that they do not have adequate resources for all educators at the school and the limited resources that were purchased by the school is loaned to educators during the school day. Due to the lack of funds for ICTs, they do not have projectors for every class mounted at the school. The laptops and projectors that are used by some educators must be carried around from class to class which is time consuming and frustrating to connect, disconnect and reconnect. The participants in the non-ICT township school mentioned that the educators are not using technology in their teaching as they don't have the privilege of being exposed to such resources to be able to use them. The resources that were provided to the administrators and senior management were provided to the school by the Gauteng Department of Education for administrative purposes only. The township ICT school, on the other hand, only caters for the grade 7 classes specifically as the DoE provided tablets for learners which are upgraded annually, laptops that were provided to grade 7 educators once off in 2016 and Smartboards were installed in the grade 7 classrooms; the rest of the educators throughout the other grades were not privileged to receive digital devices. The school, being a non-fee-paying school, was not able to cater for the rest of the grades. The suburb ICT school on contrary managed to provide all educators across the grades with Smartboards installed in their classrooms and laptops in 2016. DoE provided the grade 7 classes with Smartboards, Laptops, and tablets;

The rest of the electronic devices that were provided to the classes across the other grades, were sponsored from an external service provider. The participants, however, highlighted that although they have some sort of ICT resources available, these resources are old and outdated and are in need to be replaced and/or upgraded. The resources were not well maintained due to lack of funds Ongoing maintenance costs, crucial for the proper functioning of ICT infrastructure, are constrained by limited financial resources, leading to a decline in performance and reliability over time (Mabila, J., Van Biljon, J., & Herselman, M, 2017). Financial limitations also result in the use of outdated ICT equipment and technology, impeding effective integration in classrooms and depriving learners and educators of access to the latest tools. These financial challenges impact maintenance, causing reduced system performance and increased downtime, frustrating both learners and educators (Munje, P. N., & Jita, T, 2020). Participants indicated that the internet access range was limited in the schools. Whist some participants mentioned that they can only access internet in the admin area, others mentioned that the connectivity around the school was poor and disruptive. (Chisango, G., & Marongwe, N, 2021) mention that limited funds impede the development of robust network infrastructure, affecting the smooth operation of online learning platforms. The struggle to create dedicated ICT facilities, including computer labs and smart classrooms, also hampers learners' exposure to essential tools, hindering the development of crucial digital literacy skills (Dzansi, D. Y., & Amedzo, K, 2014). Additionally, General challenges faced in many South African schools also has huge financial implications in the implementation of ICT integration. These constraints include safety and security of the resources and continuous uninterrupted power supply. Participant SNICT1 categorically asserted that persistent theft rendered the school's 45-computer lab established in 2012 inoperable. Consequently, learners lacked access to these valuable resources within the classroom environment, as the prohibitive cost of both device replacement and enhanced security measures deterred further investment. Notably, school managers from both ICT-equipped suburban and township schools readily attributed the security challenges to the Department of Basic Education (DBE). While the DBE supplied grade 7 learners and educators with ICT resources, they placed the responsibility for safeguarding these resources on individual schools. This onus was particularly onerous for schools situated in socioeconomically disadvantaged communities, given the DBE's expectation that each school independently finance its own security measures. Numerous reports from diverse regions across the country underscore the prevalent issue of computer theft, particularly within certain South African contexts Mabuza, 2020; Mpunje & Jita, 2020; Ngqakamba, 2020; Mabila, Biljon & Herselman, 2017). In these instances, educational institutions equipped with ICT resources encounter persistent security challenges, thereby negatively impacting the seamless integration of ICT into educational practices. It is noteworthy that this challenge extends beyond the borders of South Africa. Hussein, Abayo, and Mugambi

(2019) reported on similar security concerns in other countries. Adding to the complexities of ICT integration, financial constraints such as the high cost of alternative power solutions in the face of frequent load shedding further impede progress. As Mabila, Biljon, and Herselman (2017) observed, these disruptions directly impact educators' ability to leverage ICT effectively. Consequently, prioritizing strategies to overcome these financial barriers is essential for ensuring equitable access to a technologically advanced and enriching learning experience for all South African learners in the digital era.

5.5.6 *Leadership*

The successful integration of ICTs in South African public schools' hinges critically on effective leadership (Rasool, 2022; Tigere & Netshitangani, 2022; Chigona & Tunjera, 2022; Tshelane, 2015; Van Niekerk, 2009). School leaders, including principals and curriculum managers, act as crucial navigators through a complex landscape encompassing financial constraints, policy frameworks, and technological advancements. To foster an environment conducive to ICT adoption, they must shape a clear vision, implement supportive policies, and develop strategic plans (Hallinger & Hosseingholizadeh, 2020).

The managers interviewed in this study expressed awareness of the digital paradigm shift and a keen interest in embracing ICT in their schools. However, their efforts are hampered by various roadblocks. In several schools, particularly those lacking pre-existing ICT infrastructure, resource scarcity stands as a formidable obstacle. Participant SNICT2 highlighted the lack of educator motivation, attributing it to the absence of leadership encouragement and limited resources. This echoes Mooketsi's (2020) and Simmin & Sani's (2015) observation that positive leader attitudes positively influence ICT implementation.

Financial constraints further exacerbate the challenges of resource acquisition and maintenance. The managers from non-ICT schools emphasized the prohibitive cost of purchasing and maintaining ICT equipment. Even in ICT-equipped schools, resource limitations persist. For instance, outdated and malfunctioning devices in the grade 7 classes, as reported by a manager from an ICT school, illustrate the persistent need for upgrades and support. In essence, maintaining ICTs for teaching and learning is a challenge for both non-ICT and ICT schools. Inadequate educator training emerges as another critical barrier. Participant TICT3's account of basic, insufficient DoE training underscores the need for context-specific, tailored professional development in utilizing ICTs for pedagogy (Tshelane, 2015; Van Niekerk, 2009). This aligns with Kwan's (2020) and Tingle et al.'s (2019) observation of educational outcomes being linked to a manager's expertise and knowledge. The managers themselves confessed limited technical skills, restricting their own ICT integration in teaching by *"I don't know how to use computers beyond*

administration; thus, I do not have knowledge on how I can tell educators on how to use ICT in their practice". This reinforces the need for leaders to cultivate a culture of innovation and prioritize continuous learning for themselves and their staff (Hallinger & Hosseingholizadeh, 2020).

Beyond internal challenges, effective leadership necessitates the ability to advocate for resources and navigate external complexities. Strong leaders champion equitable access to ICT across socio-economic contexts, forge partnerships with government and private entities, and actively advocate for adequate budget allocations (Rasool, 2022; Van Niekerk, 2009). The intricate relationship between leadership and ICT integration in South African public schools extends beyond mere technological proficiency. It encompasses strategic vision, administrative acumen, and the ability to navigate and overcome multifaceted challenges. By prioritizing ongoing professional development, fostering a culture of innovation, and actively advocating for resources, school leaders can unlock the transformative potential of ICT and set their schools on a path towards successful integration in the digital age.

5.5.7 Professional Development (PD)

In the current rapidly evolving educational landscape, the effective integration of ICTs into classrooms stands as a crucial determinant of learning quality. This integration hinges on the preparedness of educators, who not only need to possess the technical skills to operate technology but also understand its pedagogical potential and seamlessly weave it into their teaching practices (Ajani & Govender, 2023; Rasool, 2022; Ajani, 2020; Olika, Moses & Sibongile, 2019; Mbatha & Dlamini, 2018). However, despite existing training programs, research reveals a concerning gap in educator readiness, posing a significant barrier to successful ICT integration in South African schools. As (Chisango & Marongwe, 2021) highlight, current approaches often fall short, leaving educators poorly equipped to harness the full potential of technology for enhancing learner learning experiences. A deeper exploration of the challenges and opportunities surrounding ICT professional development for educators emphasizes the vital role it plays in unlocking the transformative power of technology in education, thereby fostering innovative teaching practices, enhancing learner engagement, and learning outcomes, and preparing learners for success in a digital-driven world.

The widespread provision of "one-off" ICT courses presents a significant barrier to effective professional development among educators, highlighting the inadequacy of current practices. This approach renders educators ill-equipped to meaningfully integrate technology into their teaching practices, emphasizing the urgent need for continuous and comprehensive professional development opportunities. The limitations of "one-off" ICT training programs for educators have been extensively documented in recent research, posing a significant barrier to effective technology integration in schools (Ajani et al., 2023; Rasool, 2022; Chisango et al., 2021). These

studies consistently highlight the inadequacy of such isolated sessions, which often prioritize basic, administrative skills like using Microsoft Office applications. This narrow focus neglects the intricacies of pedagogical ICT integration aligned with specific curriculum needs, rendering educators ill-equipped for meaningful classroom application (Chisango & Marongwe, 2021). Furthermore, the "one-shot" nature of these training courses exacerbates the issue. Knowledge fades quickly due to the lack of ongoing support and opportunities for practice, particularly for educators without personal ICT resources (Chisango & Marongwe, 2021). This disconnects between training and practical application leaves educators hesitant and unsure of how to leverage technology effectively within their classrooms. The participants emphasized that the training received, especially those from the ICT schools, was basic and short. The training had prepared them slightly to be able to use ICT for administration and basic operations, but these trainings did not prepare them for ICT integration in the classroom. The participants from the non-ICT schools did not receive any compulsory training. Some participants highlighted that they attended some basic courses on their own initiative. Consequently, educators may lack the confidence and necessary skillset to seamlessly incorporate technology into their classrooms. Further compounding the issue is the fleeting nature of these one-time courses, leading to knowledge decay over time, particularly for educators without personal ICT resources to facilitate continuous practice and reinforcement. The absence of ongoing support and opportunities for skill refinement leaves educators struggling to adapt to the ever-evolving educational technology landscape, hindering their professional growth, and ultimately diminishing the potential of ICTs to enhance learning experiences for learners.

Recent research and educator experiences clearly highlight the limitations of "one-shot" ICT training approaches, emphasizing the need for a more holistic and sustainable model for professional development (Rasool, 2022). While isolated training sessions may provide basic skills, they often fail to equip educators with the confidence and knowledge necessary to truly integrate technology into their teaching practices. Participants highlighted that there is a fear to use technology as they feel that these once off basic ICT courses does not equip them to be confident enough to integrate ICTs in the classrooms, however should communities of learning be established then they can learn from other colleagues, keep abreast of latest technologies and implementation strategies as well as be exposed to a platform that they can easily access at any given time when assistance is needed. According to Tarnanen, Kostianen, Kaukonen, Martin & Toikka (2021) van AS (2018), the establishment of communities of learning offers supportive networks where educators can collaborate, share resources, and learn from each other's experience which also forms a powerful solution to the issues plaguing current training models. These communities provide a platform for ongoing learning, fostering collaboration and resource sharing amongst educators. This collaborative environment combats feelings of isolation, a common

challenge identified by participants in various studies (Ramos, Cattaneo, de Jongh, Espadeiro, 2022; Marzano et al., 2011; Mishra & Koehler, 2006). It empowers educators to experiment with new technologies in a supportive environment, fostering innovation and moving beyond traditional teaching methods. The value of community of learning extends beyond mere knowledge sharing. As Fullan (2007) and York (2006) suggest, these communities provide a space for collective inquiry and problem-solving, allowing educators to tackle complex challenges collaboratively. Sharing successful strategies and troubleshooting common issues together reinforces learning and builds confidence in applying technology effectively within the classroom. This collective process also enables educators to adapt and customize their learning based on their individual needs and specific classroom contexts. Beyond the benefits highlighted by participants, research supports the positive impact of community learning on educator development and learner learning. Additionally, Darling-Hammond (2017) mentioned that schools with strong professional learning communities displayed significant improvements in educator practice and learner achievement.

For ICT professional development to truly empower educators, the technical support offered must go beyond generic troubleshooting. Ideally, it should be multifaceted, responsive, and aligned to the specific needs and learning goals of each program (Alemdag, Cevikbas & Baran, 2020) Effective technical support caters to various skill levels, offering tiered assistance ranging from basic setup and hardware troubleshooting to advanced configuration and pedagogical problem-solving. This ensures experienced educators receive timely solutions to complex issues, while novices have access to fundamental support during initial learning stages. Participants highlighted that educators are afraid to use technology due to fear of technical glitches during their lessons, thereby wasting time on lessons. Since technical support is not readily available, they should be trained at some level to anticipate and resolve common challenges based on the specific technologies. According to (Tshimanika et al.,2022) Regular check-ins and open communication channels can further ensure timely intervention and prevent minor issues from snowballing into significant disruptions (Buabeng-Andoh, 2012)

Effective integration of ICTs in classrooms cannot be achieved solely through technical training. It requires a deeper understanding of how educational theories connect with and inform professional development practices. Recent research highlights the crucial role of educators' pedagogical beliefs in shaping their ICT choices and practices (Fives & Gill, 2014; Kagan, 1992; Pajares, 1992; Richardson, 1996). Studies suggest that educators actively seek technologies that complement their existing philosophies and teaching methods (Tondeur et al., 2017; Tondeur et al., 2008; Liu et al., 2017; Zhao & Frank, 2003). Participants indicated that they were aware of the various ways ICTs are used in teaching and learning as they have heard of its potential, yet they

are not sure how to use these technologies to enhance their lessons due to a lack of knowledge and skills. The participants further highlighted that if they were provided with adequate ICT skills, then they would be able to use these ICT devices appropriately in their lessons. Technology is not a passive tool dictating pedagogy; rather, it serves as an adaptable instrument that can be harnessed to support various approaches to learning (Lawless & Pellegrino, 2007; Tondeur et al., 2008). Therefore, ICT professional development needs to move beyond technical skill acquisition and delve into theory-driven approaches that resonate with educators' existing belief systems. This can involve, for example, exploring how Constructivism aligns with collaborative learning platforms, or how Social Learning Theory can be implemented through online communities. By connecting theory with practice, professional development programs can empower educators to make informed decisions about technology integration, ensuring that technology serves as a tool to enhance their existing pedagogical approaches and ultimately promote more meaningful learning experiences for learners (Hu, Yuan, Luo & Wang, 2021).

The participants, aligned with the sentiments of Ajani (2020) and Ajani & Govender (2023), have voiced dissatisfaction with existing training programs, citing shortcomings in alignment with curriculum needs, timing disruptions, and overall inadequacy. To effectively equip educators, comprehensive, ongoing training programs are needed. These programs should be tailored to specific curriculum needs and pedagogical best practices, ensuring direct applicability to classroom realities. This aligns with recommendations for professional development to be relevant and context-specific (UNESCO, 2023). The lack of readily available, culturally relevant digital content poses a significant obstacle (Munje & Jita, 2020). Educators often struggle to locate appropriate materials, resorting to cobbling together fragmented resources under time constraints (Gunzo, 2020). This disrupts seamless integration and hinders innovative teaching methods. As observed in research, participants noted the limitations of pre-loaded, non-contextual content on learner tablets, ultimately resorting to supplementary online searches (Ajani, 2020, Ajani & Govender, 2023). Participants from the ICT schools, particularly the grade 7 educators in these schools, mentioned that even though they were provided with Smartboards and the learners received tablets, the lessons that they presented used the readily available content on the learners' tablets that were often not context relevant. They had to find relevant content on the internet to supplement their lessons. They further added that if they were able to create their own content then they would feel more confident and motivated about the lessons they presented. Empowering educators to create their own culturally relevant content could foster confidence and motivation, aligning with suggestions for self-directed learning within professional development (Dogan et al., 2021; Olika etal.,2019; Mbatha et al., 2018).Hence, addressing these two core areas that include training aligned with curriculum and pedagogy and development of culturally relevant digital

content , not only empowers educators but ultimately enhances learning experiences for all learners.

Professional development together with the availability of ICT resources plays a pivotal role in facilitating the effective integration of ICTs in the classroom. As educators engage in continuous learning experiences tailored to ICT resources, they acquire the necessary knowledge, skills, and pedagogical strategies to leverage technology effectively within instructional practices. Through targeted professional development initiatives, educators gain insights into the diverse ways in which ICT tools can enhance teaching and learning experiences, thereby fostering learners' engagement, collaboration, and critical thinking skills. However, the impact of professional development is significantly influenced by the availability of resources (Castro-Guzman, 2021; Chisango et al., 2021; Sithamola, 2021). The lack of adequate resources, such as access to up-to-date technology, funding for training programs, and technical support, can hinder educators' ability to fully capitalize on professional development opportunities (Munje et al., 2020; Blimpo et al., 2019). The participants expressed their frustrations at both the ICT and non- ICT schools by mentioning that the ICT resources provided to the grade 7 educators were outdated and nonfunctional, whereas the participants in the non-ICT schools expressed their dissatisfaction in inadequate ICT resources. They also mentioned that due to the lack of resources, any training received is futile as they are unable to practice what is learnt. According to (Mbatha et al., 2018), educators face challenges in implementing ICT integration due to limited access or inadequate resources. This underscores the importance of addressing resource disparities to ensure equitable access to quality professional development opportunities for all educators (Chisango et al., 2021; Munje et al., 2020). Consequently, the integration of ICTs in the classroom is not merely reliant on development of educators and on the ongoing support but also access to technology to effectively utilize these resources to optimize learners learning outcomes.

Furthermore, the journey towards successful ICT integration in classrooms extends beyond simply providing training and resources. Monitoring and evaluation practices play a crucial role in ensuring the effectiveness of professional development programs and their ultimate impact on classroom practices. As Bernadine (2019) emphasizes, the absence of robust monitoring and evaluation can render development efforts "invisible and inconsequential". The participants highlighted that there is no form of monitoring, evaluation, and support in terms of the use of ICT in teaching and learning. Participants use technology when it is suitable and convenient and they also mentioned that due to the lack of involvement in monitoring the ICT integration process from the side of management, they receive very little support and are discouraged from attempting to use ICTs in their classrooms. The managers mentioned that it was a tedious task to monitor educators ICT usage in the classrooms due to their workload and time constraints. Furthermore,

they highlighted that it is a futile process to monitor ICT integration in educators' classrooms as they are more concerned with the end results of curriculum coverage matters not the process. Effective monitoring and evaluation go beyond mere data collection. It involves a cyclical process that begins with clearly defined objectives aligned with program goals and the specific context of schools and educators. This aligns with the UNESCO (2023) call for context-specific monitoring and evaluation frameworks in education. Stakeholders like educators and administrators in the monitoring and evaluation process foster ownership and accountability, leading to more sustainable improvement (Fullan, 2015). The data gathered through monitoring and evaluation serves multiple purposes. It helps track progress towards established objectives, identify challenges and areas for improvement, and inform evidence-based decision-making for program refinement (Oseko, 2021). Monitoring and evaluation process might reveal insufficient technical support as a barrier to educator confidence in using technology, prompting adjustments to the program or the allocation of additional resources. Ultimately, robust monitoring and evaluation ensures that professional development programs are not delivered in a vacuum but continuously adapted to meet the evolving needs of educators and effectively support their journey towards successful ICT integration.

CHAPTER 6: Discussion

In the ensuing discourse, the identified sub-themes are subjected to critical analysis through various lenses. Theme 1 is intricately interwoven with Theme 2, as it serves as the foundational underpinning for the predominant area discerned, encompassing all other sub-themes within its ambit.

6.1 Ambiguous ICT policies

The South African government's aspirations for leveraging ICTs to transform education are outlined in various policies, including the White Paper on e-Education (2004); Strategy for Information and Communication Technology in Education framework (2014); National Integrated ICT Policy White Paper (2016); and the 2021 "Enhancing ICT Readiness". However, despite these ambitious visions, reality paints a concerning picture of ambiguous policies, inconsistent implementation, and a disconnect between rhetoric and practice. A key shortcoming lies in the one-size-fits-all approach that has not considered the contextualized environment of each school. This failure to acknowledge the unique challenges faced by individual schools has significantly hindered the successful implementation of ICT pedagogical integration. This analysis delves into the critical shortcomings of these policies and their impact on achieving the desired educational transformation.

Ambiguity and Misinterpretation: A major critique lies in the lack of clarity and specificity within the policies (Isaacs, 2020; Kirlidog, van der Vyver, Zeeman & Coetzee, 2018; Nlovu, 2016; Padayachee, 2017; Vandeyar, 2013). Terms like "equitable access" and "meaningful integration" remain undefined, leaving educators and stakeholders to interpret them differently, leading to inconsistent implementation across schools and regions (Jita, 2020; Gunzo, 2020; Ajani & Govender 2023). This ambiguity creates confusion and hinders effective planning and resource allocation, ultimately hampering the policy's intended impact. While educational policies frequently advocate for ambitious objectives, such as eliminating the digital divide and empowering educators through technology, the practical realities often paint a starkly contrasting picture (UNESCO, 2023). Resource constraints, inadequate infrastructure, and insufficient training act as significant impediments to achieving these laudable goals. The failure to address these fundamental challenges creates a chasm between aspirational rhetoric and tangible implementation, leaving educators grappling with the arduous task of translating lofty ideals into meaningful action. This persistent disconnect erodes trust in the policy itself, fostering frustration and disillusionment among stakeholders.

Effective policy implementation relies heavily on transparent and comprehensive communication with stakeholders. However, South Africa's ICT policies currently exhibit a critical

communication gap. Notably, a significant portion of participants lacked awareness of the 2004 White Paper on e-Education and the school's ICT policy. While some vaguely associated the White Paper with technology-aided teaching, their understanding remained limited. Similarly, uncertainty surrounded the existence of a school ICT policy. School managers, albeit aware of the White Paper, admitted to limited understanding due to a lack of formal workshops or presentations. Regarding the school ICT policy, managers from ICT schools acknowledged its existence, emphasizing details on device management and maintenance procedures. Conversely, non-ICT school managers reported the absence of a dedicated ICT policy, with management and maintenance aspects embedded within broader policies like asset registers and LTSM protocols. Supporting research conducted by Dlamini (2023) underscores the critical role of transparent communication in effective policy implementation. The identified lack of awareness among educators and key stakeholders regarding policy content and its implications presents a significant barrier to successful implementation and fosters disengagement. This absence of clear communication and collaborative dialogue further undermines the potential for shared ownership and collective effort required to achieve the policy's intended objectives.

By addressing these critical issues and fostering a culture of collaboration and accountability, South Africa can move towards a more effective and equitable implementation of its ICT policies. This will pave the way for technology to truly become a transformative force in education, empowering educators and unlocking the full potential of learning for all learners.

6.2 Inadequate ICT Resources

The potential of ICTs to transform education hinges not only on robust training and pedagogical frameworks, but also on the very foundation upon which it rests which is adequate resources. Unfortunately, the widespread scarcity of ICT resources in many educational settings casts a long shadow, impeding meaningful integration and perpetuating inequities in learning opportunities. Participant narratives underscored a critical impediment to the integration of ICT in education, elucidating the glaring inequality in resource access. This disparity not only dampened educator motivation but also delineated a nuanced dynamic of "haves" and "have-nots" within the study cohort. The stark contrast between the suburb ICT school, endowed with resources spanning all grades, and the ICT township school, which only extended provision to grade 7 educators and learners, epitomized this intra-school digital divide. Such disparities likely engendered varying levels of motivation among educators within the same institution. Compounding the issue, the suburban non-ICT school managed to procure some albeit insufficient resources, while the township non-ICT schools grappled with a complete lack of access. This inter-school digital chasm portrayed a disconcerting narrative of uneven resource distribution, exacerbating potential

demotivation and impeding ICT integration universally. Participants' perspectives underscore a pivotal obstacle to ICT integration: the dearth of motivation stemming from disparate resource distribution. While the ICT school boasts comprehensive resources across all grades, the township non-ICT school remains wholly unequipped, epitomizing a profound intra-school digital divide. Coupled with inadequate resources in non-ICT schools and the township ICT school's limited provision for educators, this delineates a broader inter-school digital schism that undermines educator motivation and perpetuates educational inequities. These disparities necessitate urgent attention to bridge the digital divide and ensure equitable access to resources for all learners.

The scarcity of resources manifests in various interconnected ways, presenting significant challenges to the successful integration of ICT in education. Researchers concur with this perspective, highlighting the essential role of adequate resources as the cornerstone for effective ICT integration (UNESCO, 2023, Gunzo, 2020; Padayachee, 2017 Chisango et al., 2020; Tshimanika et al., 2022). They echo the concerns voiced by participants regarding budgetary constraints, outdated technology, insufficient learner-to-device ratios, unreliable internet connectivity, and the paucity of culturally relevant digital content. These constraints impede learner engagement, disrupt the flow of lessons, and undermine educators' confidence in incorporating technology into their teaching practices (ISTE, 2019). Budgetary limitations frequently restrict schools from procuring sufficient devices, resulting in the use of obsolete technology or inadequate ratios of learners and educators to computers, thus impeding the effectiveness of classroom instruction. Furthermore, unreliable internet connectivity (Tate et al.,2022) disrupts lesson delivery and restricts access to interactive educational resources. In addition to hardware limitations, the scarcity of resources extends to the availability of high-quality digital content, presenting educators with challenges in sourcing culturally relevant materials aligned with their curriculum requirements (Munje et al., 2020). This fragmented approach to resource procurement not only disrupts the flow of lessons but also diminishes the potential for technology to enhance and personalize learning experiences. Moreover, the unequal distribution of resources disproportionately affects educators in under-resourced schools and communities, exacerbating pre-existing educational disparities (Isaacs, 2020). These schools often lack qualified personnel to support ICT integration, hindering educator confidence and experimentation with technology (Gunzo, 2020; Torres & Giddie, 2020).

Addressing these challenges necessitates a multi-pronged approach, including increased governmental funding for upgrading school infrastructure, providing devices, ensuring reliable internet connectivity, and developing culturally relevant digital resources. Additionally, ongoing professional development programs specifically addressing resource scarcity can equip educators with the skills and strategies to optimize limited resources and maximize the impact of technology

in their classrooms. However, critics such as (Rao, Gravel, Rose & Tucker-Smith, 2023; Kioupi & Voulvoulis, 2022; Shah, 2022) argue that educators should strive to integrate ICTs even in the face of resource limitations. They may point to instances of innovative educators who adeptly utilize readily accessible tools and online content to craft engaging and enriching learning experiences (Padayachee, 2017; Donnelly, McGarr & O'Reilly, 2011). While these examples are commendable, it is essential to recognize the systemic challenges and inequities elucidated by participants and researchers. Acknowledging these issues necessitates a multifaceted approach to address the underlying causes of resource scarcity and inequity in ICT integration. One potential solution involves fostering collaboration between educators and stakeholders to identify and implement cost-effective strategies for maximizing existing resources. This may entail repurposing outdated technology, leveraging open-source software and digital platforms, and capitalizing on community partnerships to access additional resources. Moreover, targeted investments in infrastructure and technology procurement, coupled with comprehensive professional development programs, can empower educators with the skills and resources needed to effectively integrate ICT into teaching and learning. Additionally, initiatives aimed at promoting digital literacy and equitable access to technology across diverse communities are essential for mitigating disparities and ensuring inclusive ICT integration. By addressing these systemic challenges head-on and fostering a culture of innovation and collaboration, educators can navigate resource constraints more effectively and create equitable opportunities for all learners to engage with technology-enhanced learning experiences.

While ICTs harbor vast potential to revolutionize education, their efficacy hinges crucially upon equitable access to resources. The stark reality of resource scarcity paints a disconcerting image of the "digital divide," both within schools and among them, obstructing effective integration and perpetuating educational inequalities. Therefore, addressing this challenge is paramount to cultivating a genuinely inclusive and technology-enriched learning environment wherein all learners, irrespective of their backgrounds, can harness technology's transformative prowess for academic excellence. Looking ahead, a multi-faceted approach is imperative. Increased government funding remains indispensable to ensure equitable access to technology within and across schools. This investment ought to extend beyond mere device provision, encompassing dependable internet connectivity, infrastructure enhancements, and robust technical support. Furthermore, initiatives for content development must prioritize the creation of culturally relevant and curriculum-aligned digital resources readily accessible to educators. Investing in the production of high-caliber content that caters to diverse contexts and needs is imperative to ensure that technology functions as an instrument of inclusion rather than exacerbating marginalization. Lastly, targeted professional development programs tailored to address resource scarcity are indispensable. Endowing educators with the competencies and methodologies to optimize limited

resources, harness readily available tools, and nurture innovative pedagogical practices is pivotal to maximizing technology's impact in classrooms.

By actively redressing the digital divide through sustained investment, focused content development, and the empowerment of educators, we can chart a course toward a future where technology acts as a conduit, not an obstacle, to opportunity and academic achievement for all learners. This comprehensive approach harbors the potential to unleash the full transformative potential of ICTs in education, forging a genuinely equitable learning landscape for generations to come.

6. 3 Net Generation educators versus the older educators

The educational landscape has been profoundly reshaped by the widespread adoption of ICTs ushering in a new era characterized by unprecedented access to digital resources and tools. However, within this digital milieu, a discernible schism emerges between net generation educators, born after 1980, and their predecessors from earlier generations, which is evident in their distinct approaches to the pedagogical integration of ICTs (Kirschner & Bruyckere, 2017; Prensky, 2001). The incorporation of ICTs within South African educational settings unveils a nuanced interplay between generational perspectives and disparities in resource access. Younger educators belonging to the "Net Generation" exhibit a greater propensity to explore and utilize technology in their instructional practices, showcasing enhanced levels of comfort and proficiency, even beyond formal lesson contexts. However, challenges arise when examining implementation across different school contexts.

In the non-ICT suburb school**,** the manager mentioned that older educators often exhibit technophobia due to limited ICT skills, creating a reliance on traditional methods. The cumbersome nature of transporting projectors further restricts technology usage. In the non-ICT township school, the digital divide widens significantly. Even younger educators lack access to ICTs within the school and their personal devices mainly serve administrative purposes. The lack of resources like projectors further hinders pedagogical integration. ICT schools present a mixed picture. Whilst all educators in the suburb ICT school had access to Smartboards, older generation educators tend to use technology sporadically or not at all, the policy requiring the use of ICT was limited to educators of Grade 7, who were all younger educators. In contrast, the ICT schools in the township exhibited a disparate situation. Grade 7 educators were mandated to incorporate ICTs into their teaching practices, while educators teaching other grades lacked access to any ICT resources, hindering their ability to integrate such technologies. Despite the willingness of younger educators to experiment with ICT-based teaching methods, they encountered obstacles preventing their implementation. Conversely, older educators displayed limited enthusiasm for

utilizing technology in their teaching despite acknowledging the significance of the digital age, a sentiment seemingly divorced from its impact on their instructional approaches. This discrepancy within and between schools widens the digital divide, with older educators' lack of confidence, skills, and motivation acting as additional barriers.

Net generation educators, having grown up immersed in digital technologies, exhibit a natural propensity for technological fluency and digital adeptness (Voogt & Pelgrum, 2009). This translates into a predisposition towards incorporating ICTs into their teaching practices. They readily leverage diverse digital tools and resources, aiming to enhance learner engagement and learning outcomes (Ertmer & Ottenbreit-Leftwich, 2013). Conversely, older educators, lacking the early exposure to technology, may harbor hesitancy or resistance towards ICT integration (Warschauer, 2004). While acknowledging the potential of technology in education, they often face challenges in adapting their pedagogical approaches to effectively incorporate ICTs. Perceived unfamiliarity with technology**,** resistance to change**,** and apprehensions about technological complexities can act as impediments (Majackie, 2022). This creates a divergence in the way ICTs are integrated into classrooms, with net generation educators readily embracing technology and older educators potentially requiring targeted support and training to bridge the digital gap and transition towards more digitally oriented instructional practices (Jansen van Rensburg, et al., 2021).

6. 4 Financial Constraints

The landscape of education in South Africa is marked by stark disparities in access to resources, significantly impacting pedagogical ICT integration. Financial constraints stand as a formidable barrier, with funding limitations impacting all aspects of school infrastructure and maintenance, including critical ICT resources. Several factors contribute to this deficit.

One key issue is the unequal distribution of government funding. While the National Education Department allocates funds based on the Norms and Standards for School Funding (NNSSF), these formulas have been criticized for inadequately addressing inequities (Smit, 2020; Mestry, 2022; du Plesis, 2020; Chanee, 2020; Spaull & Van der Berg, 2020; Sayed, Motala, Carel & Ahmed, 2020). Schools in poorer communities often receive less per learner, perpetuating a cycle of disadvantage. Additionally, budget shortfalls and competing priorities within the public sector often led to delays or insufficient allocations for technology maintenance and upgrades (Jita et al., 2020).

The divergent school fee structure further exacerbates the issue. No-fee schools, catering to underprivileged communities, prioritize meeting basic needs like nutrition programmes, stationery, textbooks, building maintenance and services, leaving little room for ICT investment

(Msila, 2020). Conversely, suburban schools exhibit significant disparities in school fees, dictated by the discretion of their respective School Governing Bodies (Buys et al., 2020). This fee-based system grants wealthier suburbs, boasting higher fee structures, the capability to allocate dedicated budgets for technology**,** Suburb schools with low fee structures face a unique challenge - balancing the affordability needs of their communities with the financial demands of running a quality educational institution. This often translates into a struggle to meet daily operational costs, including the provision of critical resources like technology (Karlsson, McPherson & Pampallis, 2020). These schools cater to communities where parental affordability may be limited, necessitating low fees to ensure access to education. However, this financial constraint can create a tension between accommodating accessibility and ensuring the basic infrastructure and resources necessary for effective learning. This precarious financial balance carries implications for technological integration**.** Suburban schools with limited budgets may find dedicating resources to digital tools a difficult proposition. While wealthier suburban schools with higher fees can readily allocate budgets for technology, those with lower fees may be forced to prioritize immediate operational needs**,** leaving ICT integration on the back burner. This disparity creates an uneven playing field, where access to technology and its potential benefits becomes contingent on socioeconomic factors, exacerbating educational inequalities (Smit, 2020; Mestry, 2020; du Plesis, 2020)**.**

This fee-based disparity reinforces existing socioeconomic inequalities, where poorer schools struggle to bridge the digital divide even with government support (Maistry & Afrika, 2020; Sayed et al.,2020 Participants, comprising educators and managers from both ICT and non-ICT schools, emphasized the disproportionate distribution of resources as a key barrier. Learners in township schools (Quintile 1 & 2**)**, characterized as impoverished communities and non-fee-paying institutions, although these schools received a high government funding, face significant technological disadvantage. Interestingly, managers from fee-paying schools (Quintile 3-5), specifically the two sampled suburb schools that were classified as Quintile 5**,** reported similar challenges, even with the low government funding supplemented with school fees. They claimed their learner bodies primarily originate from nearby townships, potentially indicating inaccurate quintile categorization or highlighting the pervasiveness of economic hardship across communities. This aligns with (Maistry et al.,2020; Sated et al., 2020; Spaull et al., 2020) who critique the quintile system for perpetuating resource inequality, with lower quintiles receiving more funding to serve the underprivileged communities. Quintile 5 schools, on the other hand, receiving the least government support, further struggle due to exceptionally low school fees implemented to cater to their impoverished demographics. Many parents are exempt or partially exempt, placing the burden of basic operational costs entirely on the school's shoulders, leaving minimal or non-existent budgets for ICT resources. Participants emphasized the priority granted to

ensuring every learner possesses a textbook (universal coverage), as mandated by the Draft Learner, Educator & Support Material policy (LTSM, 2014). In this case, the constant need to replace damaged or lost textbooks consumes most government-allocated resources, leaving ICTs marginalized due to budgetary constraints. The complex interplay between socioeconomic demographics, funding mechanisms, and policy implementation, ultimately painting a concerning picture of educational inequality and technological disparity in South African schools.

The consequences of these financial constraints are far-reaching. Schools lack the resources to purchase, maintain, and update equipment, resulting in outdated technology, limited access to internet connectivity, and inadequate educator training on ICT integration (Jita et al., 2020). This impedes the implementation of effective pedagogical practices that leverage technology to enhance learning, ultimately widening the achievement gap between advantaged and disadvantaged schools (Chisango et al., 2021; Buys, du Plesis & Mestry, 2020; Chanee, 2020).

Addressing this challenge requires a multi-pronged approach. Revising the NNSSF formula to account for socioeconomic factors and ensuring transparent budget allocation are crucial first steps. Implementing innovative funding mechanisms, such as public-private partnerships or targeted technology grants, could further bolster resource availability. Additionally, reconsidering the school fee structure to promote equity and ensure all schools have the basic resources for ICT integration requires careful consideration and community engagement. Ultimately, addressing the financial constraints hindering South African schools' access to ICT resources is critical to ensuring equitable educational opportunities in the digital age.

6.5 Leadership

The success of pedagogical ICT integration hinges not only on educators' skill and availability of resources, but also on the critical role of school leadership. Leaders act as advocates, facilitators, and visionaries, shaping the school's ICT landscape and influencing educator motivation. However, this role remains complex, nuanced, and often fraught with challenges.

Leaders' personal ICT proficiency directly impacts their ability to motivate and guide educators (Ertmer & Ottenbreit-Leftwich, 2013). Leaders confident in their technological skills can model effective integration, providing targeted support and generating educator enthusiasm (Ertmer & Ottenbreit-Leftwich, 2013). Conversely, leaders lacking such confidence may retreat from promoting technology, potentially reinforcing educator resistance (Moersch, 2016). This study's findings resonate with existing literature regarding the leadership-technology integration nexus. The participants, all school managers, reported primarily using ICTs for administrative purposes like Word, email and online meetings. Their limited engagement with technology for pedagogical integration aligns with concerns raised by Gordon (2021); Ertmer & Ottenbreit-Leftwich (2013);

Moersch (2016). It suggests that these leaders' basic ICT skills might be hindering their ability to champion and model pedagogical integration for educators.

This highlights a potential gap between the leadership's current ICT usage and their capacity to drive technology-enhanced learning across the school. The current reality of leaders predominantly using ICT for administrative tasks creates a significant barrier. This narrow focus sends a message that technology holds limited value for pedagogy, impacting educator perception and willingness to experiment (Abedi, 2023; Wright, 2020). Effective leaders must transition beyond administrative use, engaging with educators to explore innovative pedagogical applications and demonstrating the potential of ICT to enhance learning (Kilag, Tokong, Enriquez, Deiparine, Purisima & Zamora, 2023).

Financial constraints remain a major hurdle for many schools. Effective leaders must exhibit ingenuity and resourcefulness, seeking collaborative solutions to bridge the ICT gap. This could involve partnering with communities, leveraging local expertise, exploring alternative funding models like renting school facilities, or fostering data-sharing networks (Kodua-Ntim, 2023). participant, specifically identified as a grade 7 educator from an ICT school located in the suburban area, articulated that the exclusive presentation of lessons within the classroom, without incorporating interactive activities, stems from the lack of universal access to data and resources among learners within their school community. This deficiency poses a significant barrier to engaging learners in interactive educational activities, even if educators possess the requisite skills. Moreover, the educator expressed concerns regarding exacerbating inequality among learners if interactive lessons were implemented, as some learners possess ICT devices and access to data while others do not. Additionally, the participant advocated for community involvement to expand the reach of Wi-Fi networks, thereby facilitating access to data for disadvantaged learners and potentially fostering the integration of ICT pedagogy. This perspective resonates with the advocacy of Michener (2015), who similarly advocated for data sharing between more affluent and underprivileged communities to address digital disparities, promote equitable access to educational resources and to foster inclusive educational practices. Leaders' innovative ability to network and collaborate amongst various stakeholders can facilitate such a partnership. The leader's personal beliefs about ICT profoundly influence the school's technology integration journey. Leaders who view technology as a transformative tool, capable of enriching learning and promoting equity, are more likely to create a supportive and innovative environment (Warschauer, 2004). By fostering a culture of professional development, experimentation, and collaborative learning**,** leaders empower educators to become confident and competent users of ICT in their classrooms (Ertmer & Ottenbreit-Leftwich, 2013).

School leaders hold the key to unlocking the transformative potential of ICT in education. Through consistent advocacy, strategic vision, and collaborative leadership, they can empower educators, overcome resource constraints, and create a school environment where technology seamlessly supports and enhances learning. As we move forward, fostering a new generation of technology-savvy leaders will be crucial to ensuring equitable access to the benefits of ICT and closing the digital divide for all learners.

6.6 Professional Educator Development

The transformative potential of ICTs in education is widely acknowledged (UNESCO, 2022). However, this potential hinges on the professional development of educators, equipping them with the necessary knowledge, skills, and support to leverage technology effectively (Mishra & Koehler, 2006). This study delves into the intricate interplay between educators' ICT competencies, implementation strategies, and learners' developmental outcomes, navigating the diverse landscape of educational theories such as behaviorism, cognitivism, constructivism, and social learning. Recognizing the constant evolution of this field, the research adopts a holistic approach, avoiding reductionism and emphasizing the significance of critical reflection and continuous development (Fullan, 2007).

Effective integration of ICT in education demands a continuous and comprehensive approach to professional development for educators, surpassing mere technical training (Tschofen, 2012). This involves several key dimensions. First, pedagogical training is essential to equip educators with strategies that harness ICT for promoting critical thinking, collaborative learning, and social awareness, as outlined by the International Society for Technology in Education (ISTE, 2021). Strategies such as project-based learning, learner-led discussions, and online simulations exemplify the relevant pedagogical approaches. Second, technical proficiency is crucial, and training programs should empower educators to navigate digital tools, create engaging multimedia content, and troubleshoot effectively (Cobb et al., 2003). This includes access to user-friendly platforms, readily available tutorials, and technical support. Third, a critical analysis of ICT is imperative, and educators need support in evaluating online content and platforms, considering potential biases and limitations (Warschauer, 2004). Employing media literacy frameworks and engaging in collaborative discussions can enhance educators' critical appraisal skills. Lastly, community collaboration plays a pivotal role, with fostering collaboration among educators through online communities, forums, and professional learning networks being crucial for sharing best practices and resources (Timperley & Cook, 2000). Collaborative activities such as lesson planning, online peer coaching, and joint project development serve as valuable avenues for knowledge exchange in the educational landscape. Educator readiness, despite existing training programs, remains a significant barrier to effective ICT integration in South African schools.

Chisango and Marongwe (2021) reveals the limitations of current approaches. Many educators receive only a single, introductory training session focused on basic Microsoft Office skills, insufficient for confident classroom integration. For those lacking personal ICT resources, this knowledge quickly fades. Participants emphasized the need for ongoing training that is relevant for ICT integration in the classroom due to the rapid evolution of technology. Instead of curriculum-technology integration, the focus often tilted towards administrative tasks like document creation, presentations, internet use, and spreadsheets. This disconnects, coupled with limited ongoing support, leaves educators feeling underprepared and hesitant to experiment with new technologies in the classroom. The inadequacy of training programs that are characterized by once-off training sessions and generally basic, both in scope and content, exacerbates hindering the full potential of ICT integration in enhancing educational experiences for South African learners. Participants highlighted the need for appropriate training that closes the gap between the content and pedagogy.

The dearth of readily available, culturally appropriate digital content presents a significant pedagogical barrier. Munje and Jita (2020) underscore the ubiquity of generic content that deviates from local curricular imperatives, hindering effective teaching. Corroborating this, participants across both ICT and non-ICT schools who attempt ICT integration, and especially the township ICT schools Grade 7 educator, revealed a heavy reliance on YouTube videos for instruction. However, the participant readily acknowledged the rarity of perfect content matches. Consequently, educators are forced to cobble together fragmented video segments to construct comprehensive lessons, often under tight time constraints (Gunzo, 2020). This challenge to source appropriate materials impedes seamless technological integration into teaching methodologies and inadvertently perpetuates traditional, non-technology-driven approaches. Moreover, participants expressed a strong desire for "digital content creation" training, envisioning it as key to generating locally contextualized content. Intriguingly, the Township and Suburb ICT school Grade 7 educators also mentioned insufficient department-provided materials, necessitating further content sourcing. Addressing this content paucity through policy interventions is crucial for successful ICT implementation. Furthermore, if a policy is rolled out for implementation, it should be monitored.

For educators, understanding educational theories is crucial, especially when integrating ICT into their classrooms. These theories illuminate the intricate relationship between technology, teaching methods, and how learners learn. They act as unique lenses, within educator training, for comprehending the processes of knowledge acquisition and learning. Combining these theories, like behaviorism, cognitivism, constructivism, and social learning, with the transformative power of ICT unlocks the potential to create engaging and effective learning experiences. This

exploration delves into newer perspectives like connectivism and collaborativism in the contemporary teaching and learning environment. Within the realm of ICT, behaviorism leverages technology's potential for reinforcement and behavior shaping. It highlights the importance of clear instruction and feedback, guiding educators in utilizing ICT for efficient skill practice and assessment. This aligns with the principles of theorists like Skinner (1958), whose influence is evident in gamified learning platforms (Sailer et al., 2017). These platforms utilize points, badges, and leaderboards to create engaging scenarios that promote repetition and knowledge retention. Additionally, online quizzes, advocated by educational theorists like Clark & Clark (1984) provide immediate feedback, reinforcing newly acquired knowledge (Mayer, 2011). Similarly, interactive simulations guided by ICT as echoed by Gagne (1982), facilitate practical skills practice and feedback, resembling shaping behaviour (Mayer, 2014). Furthermore, data analytics derived from ICT usage, allow for the personalization of learning pathways, tailoring instruction, and feedback to individual needs (Siemens, 2013).

Despite these strengths, behaviorism within the ICT context has faced criticism for oversimplifying the learning process and neglecting the complexities of cognition (Duch, 2012). Critics like Papert (1993) argue that the behaviorist model, centered on stimulus-response mechanisms, risks prioritizing extrinsic rewards like points and badges over fostering deeper understanding and intrinsic motivation (Duch, 2012; Przybylski, Deci, Rigby & Ryan., 2014). Ethical considerations also arise regarding potential manipulation and control inherent in behaviorist approaches, as highlighted by Burbules & Phillips (2000) This underscores the need for thoughtful implementation to ensure technology is used ethically and respectfully towards learners.

Participants highlighted that the use of YouTube, with its vast library of educational channels and engaging video formats, allows learners to explore diverse topics in a visually stimulating way. Complex concepts become clearer through demonstrations, animations, and real-world examples, fostering deeper understanding and retention. Participants added that animated PowerPoints, on the other hand, inject life into traditional presentations. By incorporating dynamic visuals, transitions, and interactive elements, they capture attention, improve information processing, and make learning an active experience. This powerful combination caters to different learning styles, fuels curiosity, and ignites a passion for knowledge, making learning not just informative, but truly enjoyable. Therefore, while behaviorism offers valuable tools for engagement and reinforcement within ICT-based learning, it is crucial to acknowledge its limitations and potential drawbacks. A balanced approach that integrates other learning theories and prioritizes ethical considerations is essential for creating truly effective and learner-centered experiences.

In today's rapidly evolving educational landscape, integrating ICT in the classroom is paramount for fostering cognitive thinking among learners. ICT tools provide dynamic platforms that engage learners in interactive learning experiences, stimulating their critical thinking, problem-solving, and decision-making skills. Participants in the study revealed that by incorporating ICT, educators can offer diverse resources such as multimedia presentations, educational software, and online platforms, which cater to various learning styles and abilities. However, the scarcity of resources limits this practice. Moreover, participants added that ICT facilitates collaborative learning environments where learners can exchange ideas, collaborate on projects, and engage in real-world simulations, all of which enhance learners' cognitive abilities. Furthermore, exposure to ICT from an early age prepares learners for the digital-centric workforce of the future, equipping them with essential skills for success in a technologically driven society. Thus, the integration of ICT in the classroom not only cultivates cognitive thinking but also prepares learners for lifelong learning and success in the digital age. According to Bruner (1966), Vygotsky (1978), and Piaget (1980), cognitivism focuses on knowledge acquisition and processing. It finds fertile ground in the landscape of ICT. Interactive simulations and multimedia presentations as advocated by Mayer (2005), cater to diverse learning styles by weaving together audio, visuals, and text, enhancing engagement and knowledge retention. ICT becomes a springboard for critical thinking and metacognition through tools like online research, facilitated by Jonassen (2015), where learners debate, analyze information, evaluate sources, and reflect on their own learning journeys. Blended learning approaches, pioneered by Bruner (1966), seamlessly combine online and offline activities, leveraging the strengths of both modalities for deeper exploration and knowledge solidification. However, despite its strengths, cognitivism isn't without its shadows. Critics like Duffy & Jonassen (2013) argue that the theory's emphasis on individual cognition can potentially neglect the social and cultural dimensions of learning, overlooking collaborative knowledge construction and the situated nature of knowledge. This highlights the need for ICT integration strategies that go beyond developing isolated cognitive skills through online simulations. As Gee (2004) suggests, we must ensure opportunities for collaborative learning and real-world application, allowing learners to connect their acquired knowledge to the broader social and cultural contexts they inhabit. By acknowledging both the strengths and limitations of cognitivism, educators can harness the power of ICT to create truly engaging and effective learning experiences that foster not only individual cognitive growth but also collaborative knowledge construction and deeper understanding within a real-world context.

Educational theories provide critical lenses for evaluating the potential and limitations of ICT tools in achieving specific learning objectives. Constructivism, for instance, emphasizes active knowledge construction, prompting educators to consider how ICT tools can facilitate inquiry, collaboration, and reflection. In addition, constructivism extends beyond individual cognition,

accentuating learners' active role in knowledge construction through engagement. The participants in the study highlighted they are aware of advantages ICT offers in teaching and learning. They mentioned that ICT acts as a powerful catalyst for constructivism learning by fostering active engagement, exploration, and knowledge construction. In addition, it provides diverse tools and resources that cater to individual learning styles and paces. Learners can actively engage with simulations, conduct virtual experiments, collaborate on projects, and access global information, all of which promote deeper understanding and personalized interpretation. ICT also facilitates reflection and critical thinking through platforms for online discussions, multimedia presentations, and self-assessment tools. This empowers learners to actively construct meaning, challenge assumptions, and connect new knowledge to existing understanding, solidifying their learning journey. This sentiment aligns with literature, as evidenced by Jonassen (2011) who emphasizes how online simulations and virtual environments immerse learners in complex scenarios. This immersion promotes exploration, discovery, and problem-solving, thereby supporting knowledge construction through firsthand experiences. Collaborative platforms, such as online forums and wikis, encourage interaction, idea sharing, and co-construction of knowledge through social negotiation and scaffolding (Vygotsky, 1978). However, constructivism has faced criticism for potential ambiguity in assessing learning outcomes and may pose challenges in more structured learning environments (Duffy, 1996; Cunningham, 1992). Constructivism's focus on individual knowledge construction may present challenges in assessment due to potential diverse interpretations and varying learning pathways (Duffy, 1996; Cunningham, 1992). To address this, the development of robust assessment strategies aligned with constructivist principles becomes crucial when employing ICT for learning activities (Carless, 2020). Additionally, the emphasis on learner autonomy necessitates integrating scaffolding and instructional design principles within ICT tools to mitigate potential misconceptions and support knowledge construction (Clark & Mayer, 2023).

Learning theories in general inform the design and implementation of effective ICT-mediated learning experiences. Social learning theory, for example, underscores the benefits of collaborative learning environments. This perspective encourages educators to leverage online platforms and collaborative tools to foster peer interaction and knowledge sharing. Social learning theory was advocated by theorists like Gunawardena & Zittle (1997), who emphasize that the critical role of social interaction and collaboration in knowledge acquisition is vital. Through ICT, educators can foster vibrant online communities where video conferencing and discussion forums facilitate real-time dialogue and knowledge exchange. This sentiment was also echoed by the participants who mentioned that the use of ICT in the classroom calls for collaborative and sharing of some thoughts among learners. Collaborative document editing tools further empower learners to co-create projects, cultivating shared understanding and social learning experiences. This aligns

with the socio-constructivist approach, as highlighted by Schunk (2012), recognizing the social dimension of learning and the power of peer interaction in knowledge building. However, critics like Kirschner et al. (2006) argue that social learning may neglect individual differences and the importance of explicit instruction in certain contexts. While the value of group dynamics and collaboration is undeniable, catering to individual needs and learning styles within collaborative ICT activities remains crucial. As (Kettler & Taliaferro, 2022; Lindner, Alnahdi, Wahl & Schwab, 2019; Haniya & Roberts- Lieb, 2017) advocate, incorporating differentiated instruction and personalized learning approaches can maximize learning outcomes for all. Additionally, concerns about echo chambers and misinformation amplification in online environments necessitate equipping educators with critical thinking skills and strategies to guide learners in effectively evaluating information sources within collaborative spaces.

In a world characterized by dynamic knowledge landscapes and constant information flow, traditional, siloed approaches to professional educator development (PD) fall short. Connectivism learning theory emphasizes the power of personal networks and the ability to discern and synthesize relevant information. Its integration into PD offers benefits that include among other things such as fostering active, personalized learning, cultivates collaborative knowledge construction and promotes lifelong, self-directed learning. Unlike passive lectures, connectivism PD encourages educators to curate their own learning journeys, drawing from diverse online communities, experts, and resources. This empowers them to address specific needs and interests, building knowledge relevant to their unique contexts. Connectivism theory was championed by Siemens (2006), who viewed learning as an ongoing, lifelong process facilitated by technology and networks. ICT acts as a central nervous system, enabling learners to access, filter, and connect information within their personal learning networks. Massive Open Online Courses (MOOCs), social media platforms, and knowledge-sharing communities provide fertile ground for this connected learning approach (Benckendorff & Gannaway, 2019). The situation revealed by the participating schools indicated that the educators work in isolation, there is no educator-network among them. They showed interest in educator networking but there is no promoting environment due to the lack of ICT resources. However, they use their smart phones to attend meetings virtually on MS Teams, though not convenient. However, its decentralized nature raises concerns about the reliability and validity of information acquired through diverse networks, as highlighted by Kop & Hill (2008). Building upon social learning, collaborativism, championed by Harasim (2017), emphasizes the collaborative creation of knowledge through technology-mediated interactions. ICT provides tools for real-time collaborative learning, such as writing platforms and project management software, facilitating shared problem-solving, joint meaning-making, and the development of collaborative skills essential for the 21st century workforce. However, critics like

Roschelle (2020) argue that over-reliance on collaboration may overlook individual contributions and hinder the development of independent thinking skills.

Integrating these diverse educational theories with the transformative power of ICT enables educators to create dynamic learning environments. While these theories offer valuable frameworks, acknowledging their strengths and limitations is essential for developing effective pedagogical approaches that cater to individual needs, stimulate higher-order thinking skills, and empower learners within a vibrant and dynamic educational landscape.

While educational theories provide valuable frameworks for guiding learning, their application in ICT-infused environments demands careful consideration of potential limitations (Sangrà, Vlachopoulos & Cabrera, 2012). Acknowledging these criticisms and their implications, educator development programs can play a crucial role in supporting effective ICT integration. Such programs should promote a balanced approach by encouraging the use of diverse educational theories that leverage the strengths of each while acknowledging their limitations (Sangrà, et al., 2012). They should also focus on critical thinking and media literacy, equipping educators with skills to critically evaluate ICT tools, content, and pedagogical approaches, fostering informed decision-making and responsible technology use (ISTE, 2021). Incorporating diverse learning activities is vital, involving the design of ICT-based learning experiences that cater to individual needs, promote collaboration, and connect learning to authentic contexts, ensuring all learners are engaged and challenged (Azevedo & Aleven, 2013). Moreover, prioritizing ethical considerations is essential, emphasizing responsible and ethical use of technology, respecting learner privacy, avoiding manipulative practices, and ensuring data security (UNESCO, 2021). Lastly, supporting ongoing reflection and adaptation is crucial, encouraging educators to critically reflect on their practices, adapt them based on learner needs and the evolving technological landscape, and continuously seek professional development opportunities to stay informed and skilled (Fullan, 2007). By addressing these key areas, educator development programs can empower educators to harness the power of educational theories and ICT to create truly engaging, effective, and ethical learning environments for all learners in today's dynamic educational landscape.

While ICTs offers transformative potential for education, its integration presents a nuanced landscape with complex challenges alongside exciting possibilities. Addressing the digital divide, where unequal access to technology and the internet perpetuates educational inequities, necessitates a multifaceted approach. This includes infrastructure development, affordability initiatives, and equitable access policies, as highlighted by Warschauer (2004).

Another critical challenge lies in educator training and support. Inadequate or unsustainable professional development programs often leave educators ill-equipped, as noted by Okoed (2023) and Phillips & Chetty (2018). Ongoing, context-specific training programs coupled with dedicated support systems are essential for effective ICT integration. Additionally, recognizing and addressing potential biases in online content and platforms is crucial, as they can hinder equitable learning experiences (Kozma et al., 2011). Cultivating critical thinking skills in learners and providing curated resource lists can empower informed content selection.

Furthermore, concerns surrounding commercialization and surveillance necessitate careful navigation, as emphasized by Cuban & Jandric' (2015). Implementing data protection policies, prioritizing ethical considerations, and ensuring transparency are vital elements in responsible ICT use. Unlocking the true potential of ICT requires a collaborative commitment from various stakeholders. Policymakers and education leaders play a critical role in prioritizing comprehensive, context-specific professional development programs aligned with educational goals and technological realities (ISTE, 2021). Sustainable funding, dedicated research, and effective policy implementation are key strategies in this endeavor. Beyond policymakers, professional development providers assume a crucial role in program design. As Mishra & Koehler (2006) suggest, programs should extend beyond mere technical skills training to encompass the cultivation of deep understanding, pedagogical strategies, and sustained support for educators.

Additionally, integrating technical support with ICT professional development presents both advantages and disadvantages, along with implications for educators' ongoing growth. Technical assistance influences professional development initiatives that ensures educators receive timely support and guidance when navigating new ICT tools and platforms, thus enhancing their confidence and competence in integrating technology into instructional practices (Ertmer, Ottenbreit-Leftwich, & Tondeur, 2014). This integrated approach fosters a collaborative environment where educators can troubleshoot technical challenges, share best practices, and co-construct knowledge, ultimately strengthening their capacity to leverage ICT resources effectively (Hermans, Tondeur, van Braak, & Valcke, 2008). Moreover, by addressing technical issues in tandem with professional development activities, educators are better equipped to implement innovative instructional strategies that enhance learner engagement and learning outcomes (Lin & Wang, 2012). However, the integration of technical support into professional development programs may also present challenges, such as resource constraints and logistical complexities (Tondeur et al., 2008; McAleavy, Hall, Horricks & Riggall, 2018). Additionally, educators may perceive technical assistance as a separate entity from pedagogical training, potentially hindering their ability to contextualize technical skills within instructional contexts (Zhao & Frank, 2003).

Consequently, careful consideration must be given to the design and implementation of integrated technical support and professional development initiatives to maximize their benefits and minimize potential drawbacks, thereby ensuring sustained growth.

Ultimately, educators themselves emerge as pivotal agents in this transformative journey. Their active engagement in continuous learning opportunities and effective resource utilization becomes imperative. Regularly assessing and refining practices related to ICT integration, grounded in critical reflection, stands as an essential process to ensure positive learning outcomes (Fullan, 2007). This transformative vision can be realized by acknowledging and effectively addressing the challenges at hand. Collaborative efforts involving various stakeholders contribute significantly to this endeavor. Recognizing the multifaceted and nuanced impact of educators' ICT competencies on learner development underscores the importance of continuous professional development, a comprehensive understanding of pedagogical approaches, and ongoing critical reflection. This research emphasizes the transformative potential of ICT, serving as a catalyst for a more equitable, engaging, and empowering learning experience for all involved in the educational landscape.

6.7 Conclusion

This discussion has explored the complexities of ICT integration in South African schools, highlighting the factors influencing implementation and the resulting discrepancies in access and utilization. While the national ICT policy outlines a vision for equitable access and improved learning, diverse factors at the school, educator, and learner levels create a fragmented landscape. The findings emphasize the crucial role of leadership**,** educator training**,** infrastructure, and sustainable funding in fostering successful ICT integration. Addressing these areas through targeted interventions can lead to more equitable access and empower educators to leverage technology effectively for enhanced learning experiences.

Furthermore, promoting collaborative learning**,** integrating appropriate content**,** and ensuring learner-centered approaches are essential to maximize the potential of ICTs in promoting critical thinking, creativity, and digital literacy skills. This research underscores the need for a multi-level approach that considers contextual factors and fosters collaboration between stakeholders. By addressing the identified challenges and harnessing the transformative potential of ICTs, South Africa can strive towards creating a more equitable and technologically empowered learning environment for all learners.

CHAPTER 7: Conclusion, study implications and Recommendations

7.1 Introduction

This chapter synthesizes the key findings of the research inquiry, which investigated the integration of ICTs for pedagogical purposes within public schools. Guided by the assumption that existing policy directives offer guidance on efficacious ICT use in teaching and learning, the research explored the current state of implementation and factors influencing thereof. Following a reflective overview of the research objectives, the chapter succinctly summarizes the central findings. It then elucidates the study's contribution to the existing body of knowledge regarding the implementation of pedagogical ICT integration in classroom settings, including the factors that either enable or hinder such integration. Furthermore, the chapter critically examines the limitations inherent to the study and explores the implications of the research for various stakeholders, including school leadership, educator continuous professional development and instruction, the department of education, and policymakers. Finally, the chapter concludes with valuable recommendations for future research endeavours that can further advance the understanding of this crucial dimension of contemporary education practice.

7.2 Response to Findings

The study responds to the research questions as follows:

1. How did the one-size-fits-all approach to ICT integration affect the success of ICT implementation in selected ICT and non-ICT South African schools?

   The "one-size-fits-all" paradigm governing ICT integration in South African schools has encountered considerable scrutiny due to its perceived inadequacies. Due to standardized policies and generic implementation strategies, this framework fails to accommodate the nuanced contextual realities inherent within diverse schools. Various pivotal factors impact on the implementation of ICT integration in the schools, including socio-economic disparities across schools, categorized into different quintiles, engender distinct resource challenges and infrastructure limitations, rendering a uniform approach ineffectual and exacerbating existing inequalities.

2. What are the potential drawbacks and limitations of the one-size-fits-all approach in the context of ICT implementation?

   Resource limitations present a pervasive challenge impeding the successful adoption and utilization of ICTs in South African schools, manifesting in various forms with distinct impacts on ICT integration. Financial constraints, characterized by limited budgets and

unequal distribution of resources, result in outdated equipment, inadequate access to online learning platforms, and exacerbate the digital divide between schools. Human resource challenges emerge due to educators that lack ICT training and professional development opportunities, alongside the absence of resolute technical support personnel, leading to hesitant ICT adoption and limited pedagogical innovation. Moreover, scarcity of digital content aligned with the national curriculum and unreliable internet connectivity further restrict educators' ability to utilize ICTs effectively, hindering both adoption and utilization efforts as schools prioritize basic needs over technology and face difficulties in integrating available technologies meaningfully within classrooms.

3. What framework can be effective for the transformation of ICT integration in education, drawing from the lessons learned from the sampled schools?

In the context of pedagogical integration of ICTs, the components of a conceptual framework for effective ICT integration in education typically draw from lessons learned from sampled schools and encompass several key elements. Firstly, the framework includes considerations of the educational objectives and curriculum goals, ensuring that ICT integration aligns with the broader educational mission and learning outcomes. Secondly, it addresses the technological infrastructure and resources necessary for successful integration, encompassing hardware, software, internet connectivity, and technical support mechanisms. Thirdly, the framework incorporates pedagogical approaches and instructional strategies that leverage ICT to enhance teaching and learning experiences, including differentiated instruction, collaborative learning, and project-based learning. Fourthly, professional development initiatives for educators are integral, focusing on building digital literacy skills, pedagogical competencies in ICT integration, and ongoing support mechanisms to sustain implementation efforts. Additionally, the framework emphasizes the importance of assessment and evaluation practices to monitor the effectiveness of ICT integration and inform instructional decision-making. Lastly, considerations of equity, access, and inclusivity would be embedded throughout the framework, ensuring that all learners have equitable opportunities to benefit from ICT-enhanced learning experiences. Overall, the comprehensive conceptual framework (RISE), has been developed for effective ICT integration in education, shaped by the unique contexts and experiences derived from the sampled schools, that provided guidance for sustainable and impactful implementation strategies, serving as a cornerstone for transforming educational practices towards the seamless integration of ICTs into pedagogy.

Thus, the main question was responded to: What are the key opportunities that can transform the implementation of ICT pedagogical integration in South African schools?

Despite the potential for transformation, integrating ICT pedagogically in South African schools faces considerable hurdles. Unequal access to technology and infrastructure, unreliable electricity, and internet, acts as a fundamental barrier. Many educators, lacking the necessary pedagogical skills and confidence, require ongoing relevant ICT training and support to effectively leverage ICT in their lessons. Additionally, aligning ICT integration with the curriculum demands adaptations and resources that may not be readily available. The successful integration of ICT in classrooms hinges upon the leadership's proactive engagement. Their vision and mission serve as catalysts, paving the way for meaningful implementation. Furthermore, leadership's own ICT competencies influence the advocacy and promotion of this integration. However, complacent, and innovation-averse leaders who passively observe the process risk rendering it stagnant and ultimately ineffective. Further exacerbating existing inequalities, the "digital divide" within and between schools sees both educators and learners without consistent access to devices and data falling behind their advantaged peers. Maintaining and troubleshooting technology necessitates qualified personnel, adding strain to already stretched resources. Finally, ambiguous ICT policies results in varying interpretations and implementation between schools not very which necessitates clear policies and practices.

However, these challenges are not insurmountable. ICT integration offers exciting opportunities to enhance learning such as:

- **Enhanced Learning:** ICT can foster deeper engagement, personalized learning experiences, and access to diverse resources, potentially improving learning outcomes.
- **21st Century Skills:** Integration prepares learners for a technology-driven world, developing critical thinking, communication, and digital literacy skills.
- **Collaboration and Community:** Online platforms can connect learners and educators across geographical boundaries, promoting collaboration and knowledge sharing.
- **Ongoing Educator Professional Development:** ICT can be used for professional development, improving educator skills and access to resources provided the trainings are ongoing and relevant to the context of the school and promotes ICT integration in the classroom.
- **Equity and Inclusion:** Technology can bridge learning gaps and provide differentiated instruction, potentially promoting inclusive education.
- **Innovation and Creativity:** ICT tools can foster creativity, problem-solving, and innovative thinking in learners.

While challenges exist, successful ICT integration in South African schools has the potential to transform education, empowering educators, and learners in the digital age. Overcoming these hurdles requires a multi-pronged approach, addressing infrastructure, educator training, curriculum alignment, and equitable access, while harnessing the opportunities for improved learning, skills development, and innovation.

7.3 Reflection on the Study

This inquiry examined the implementation of pedagogical ICT integration across diverse school contexts within the Johannesburg East district of Gauteng province, South Africa. The research design encompassed both ICT-equipped and non-ICT primary schools, delving into the perspectives of educators (in Foundation, Intermediate, and Senior Phases) and school managers. The study utilized qualitative methods to gain detailed insights into their lived experiences with technology use in teaching and learning, exploring both enabling factors and encountered disabling factors. Participants also shared their perceptions on strategies for fostering future appropriation and integration of ICTs into their practice. These rich data served as the foundation for developing a generic model designed to support education stakeholders in promoting effective ICT integration across all types of South African schools, irrespective of location or resources. The impetus for this investigation stemmed from a recognized gap in scientific evidence regarding the preparation of educators in the context of ICT integration. While existing literature explores broader themes of ICT integration in schools, a critical aspect was lacking such as specific examination of educators' methods for appropriating and utilizing technology within their teaching. Recognizing the potential impact of ambiguous and inconsistent policies in hindering systematic ICT integration, the study aimed to address this gap by uncovering educator experiences and perspectives, ultimately informing the development of a comprehensive generic model for future implementation in any type of South African public school.

Through a qualitative lens guided by the interpretive paradigm, this investigation explored the unique perspectives and lived experiences of primary school educators and managers as they incorporated ICTs into their teaching practices within their natural classroom settings and practice. This paradigm acknowledges the subjective nature of meaning-making in specific contexts, emphasizing the researcher's role as a co-constructor of knowledge through iterative interaction with participants. A reflection on research objectives and adopted methodology is made. Subsequently, it presents a concise summary of two central themes identified through thematic analysis of in-depth, semi-structured interviews with educators across all primary school phases (Foundation, Intermediate and Senior) and a manager, whose knowledge and proficiency with ICT was determined by analysing their comments. The themes, "Infusion of Digital Technology" and

"Barriers to ICT Integration," illuminate the nuanced influences impacting pedagogical ICT integration within South African Schools of Education. The limitations inherent to the study critically examined and explores the implications of the research for various stakeholders, including curriculum developers, educators, school leadership, and policymakers. Finally, it concludes by offering valuable suggestions for future research endeavours that can further advance our understanding of this crucial dimension of contemporary education.

The primary focus of the research centred on investigating the integration of ICT by educators within primary schools for teaching and learning purposes. The findings revealed a strong interest among educators and administrators in utilizing ICT tools; however, they encountered numerous barriers hindering effective implementation. Moreover, the research underscored significant disparities among schools regarding their approaches to integrating ICTs. Notably, it shed light on the prevalent digital divide within and between South African public schools, highlighting the uneven distribution of opportunities. The study also uncovered varying levels of ICT proficiency among educators. While some demonstrated adeptness in using certain software to augment teaching and learning, others exhibited more limited knowledge. While the grade 7 educators at the ICT school mostly used department-provided software and YouTube videos for teaching, other educators who sporadically used ICTs in the classroom mostly used PowerPoint presentation slides that lack animations and simulations that do not promote interaction among learners. Still, most educators used ICTs primarily for administrative rather than pedagogical purposes. Despite recognizing the value of ICT in teaching, their usage was constrained by both skill deficiencies and a scarcity of ICT resources.

Additionally, the research identified a gap between educators' theoretical understanding of ICT benefits and their practical application. Although educators possessed basic knowledge of ICT capabilities, they lacked hands-on proficiency, with ICT integration often being individualized rather than systemic. Moreover, the absence of comprehensive policy directives regarding pedagogical ICT integration further exacerbated these challenges. Notably, except for Grade 7 educators in ICT-focused schools, the incorporation of ICT into daily teaching practices was sporadic and disconnected from lesson planning. Continuous professional development in ICT emerged as a crucial factor in motivating educators to utilize ICT tools confidently and competently for teaching and learning purposes.

The study aimed at developing a conceptual framework/model for effective ICT integration that transcends resource limitations and instructional uniformity, enhancing learning outcomes across diverse educational contexts. Recognizing the potential transformative impact of ICTs on teaching and learning, the research adopts a multifaceted approach.

i. It delves into the identification of barriers and the assessment of educator readiness. This includes scrutinizing factors such as inadequate resource allocation, the limitations posed by a homogenized "one size fits all" approach, and the exacerbation of the digital divide due to disparities in accessibility and digital literacy. Moreover, the study evaluates educator skills and competencies, emphasizing the critical role of robust professional development and ongoing support mechanisms.

ii. This investigation meticulously examines current pedagogical practices to analyze diverse approaches and strategies employed in integrating ICTs into teaching. Drawing upon these insights, the research aims to develop a novel conceptual framework tailored to address identified barriers and elucidate best practices for successful ICT integration. By prioritizing context-specific approaches and offering targeted recommendations, this framework seeks to cater to the distinct needs and challenges encountered by various schools and educators.

iii. The study constructed a generic ICT model suitable for diverse school contexts, with a focus on enhancing educator proficiency and pedagogical integration (refer to Figure 6). By critically examining policy influences, leadership practices, and opportunities for educator education and continuous development, the research aims to inform policymakers and school leaders on fostering conducive environments for ICT integration. This comprehensive investigation endeavours to significantly advance the discourse on ICT integration in South African schools, ultimately striving to empower educators and enhance the quality of teaching and learning through the effective utilization of technology.

The study adopted Collis and van der Wende's (2002) "Hypothesized model, clusters of factors predicting current and future scenarios for ICT and educational delivery" (refer to Figure 1) offering a nuanced theoretical framework beyond technological determinism. The model recognizes the intricate dynamics between internal and external factors influencing the adoption and application of ICTs in higher education. It comprises five variable sets (A-E) that encompass a spectrum of influences on present and future ICT integration scenarios. The model begins by highlighting the pivotal role of environmental conditions and setting, encompassing institutional mission, leadership, learner and instructor characteristics, socio-economic status, and external policy. It emphasizes how these factors shape the implementation of ICT. The model then delves into policy responses, examining the coherence, adequacy, and adaptability of governmental initiatives in driving ICT integration, with particular attention to their interaction with environmental conditions. Implementation strategies are scrutinized next, shedding light on practical steps, and encountered challenges. Additionally, the model explores the actual utilization of ICT tools and stakeholder experiences, including faculty, learners, and administrators. Finally,

it considers the outcomes and consequences of ICT integration, both intended and unintended, contributing to the prediction of future scenarios.

By interlinking these diverse elements, the model attempts to predict potential future scenarios for ICT and educational delivery within an institution. It suggests that specific configurations of these factors can lead to distinct outcomes, ranging from a "Back to Basics" scenario emphasizing traditional instruction with limited technology, to a "Stretching the Mould" scenario characterized by extensive and innovative uses of ICT for teaching and learning. The utilization of the "Hypothesized model" facilitated the researcher in identifying pertinent parallels concerning ICT integration across both ICT and non-ICT public schools in South Africa. While this model furnishes institutions with a valuable instrument to conduct critical assessments of their prevailing ICT landscape and to formulate strategic trajectories for the future, it raises concerns regarding its applicability and its capacity to comprehensively encapsulate the multifaceted dynamics of ICT adoption across all educational contexts in South Africa. Certain aspects of the model's components appear incongruous or inadequately elucidated with regards to pedagogical ICT integration. Consequently, modifications were made to adapt the framework to accommodate diverse South African school contexts, irrespective of their geographical location as shown in Figure 4. This intricate interplay between technology, pedagogy, and institutional dynamics necessitates a transformative approach to ICT integration in education**.** The factors influencing the implementation of pedagogical integration of ICTs in South African schools had been considered. Recognizing the limitations of the Collis and van der Wende (2002) model in capturing the nuances of South African educational contexts, the research proposed a novel model called Resources, Infrastructure, Support, and Engagement (RISE).

Rationale for the the “RISE model”

The RISE model was developed as a direct response to the limitations identified in the Collis and van der Wende model when applied to the complex and diverse South African educational context. The existing model, while offering a valuable framework, proved inadequate in capturing the unique challenges and opportunities presented by South African schools.

Recognizing the intricate interplay between technology, pedagogy, and institutional dynamics, the RISE model was designed to provide a more comprehensive and contextually relevant framework for ICT integration. By focusing on Resources, Infrastructure, Support, and Engagement (RISE), the model addresses critical factors that significantly influence the successful implementation of ICT in South African classrooms.

The rationale for the RISE model is rooted in the need for a framework that:

- **Accurately reflects the South African context:** The model is specifically tailored to the unique challenges and opportunities faced by South African schools.
- **Emphasizes key determinants of ICT integration:** By focusing on resources, infrastructure, support, and engagement, the model highlights essential components for successful implementation.
- **Provides a holistic perspective:** The RISE model considers the interconnectedness of various factors influencing ICT integration, offering a comprehensive view of the implementation process.
- **Guides strategic planning:** The model can be used by schools to assess their current ICT landscape and develop targeted strategies for improvement.

Ultimately, the RISE model aims to contribute to the effective integration of ICT in South African schools by providing a clear and actionable framework for addressing the complexities involved.

The RISE model consists of five key components, each playing a crucial role in successful implementation.

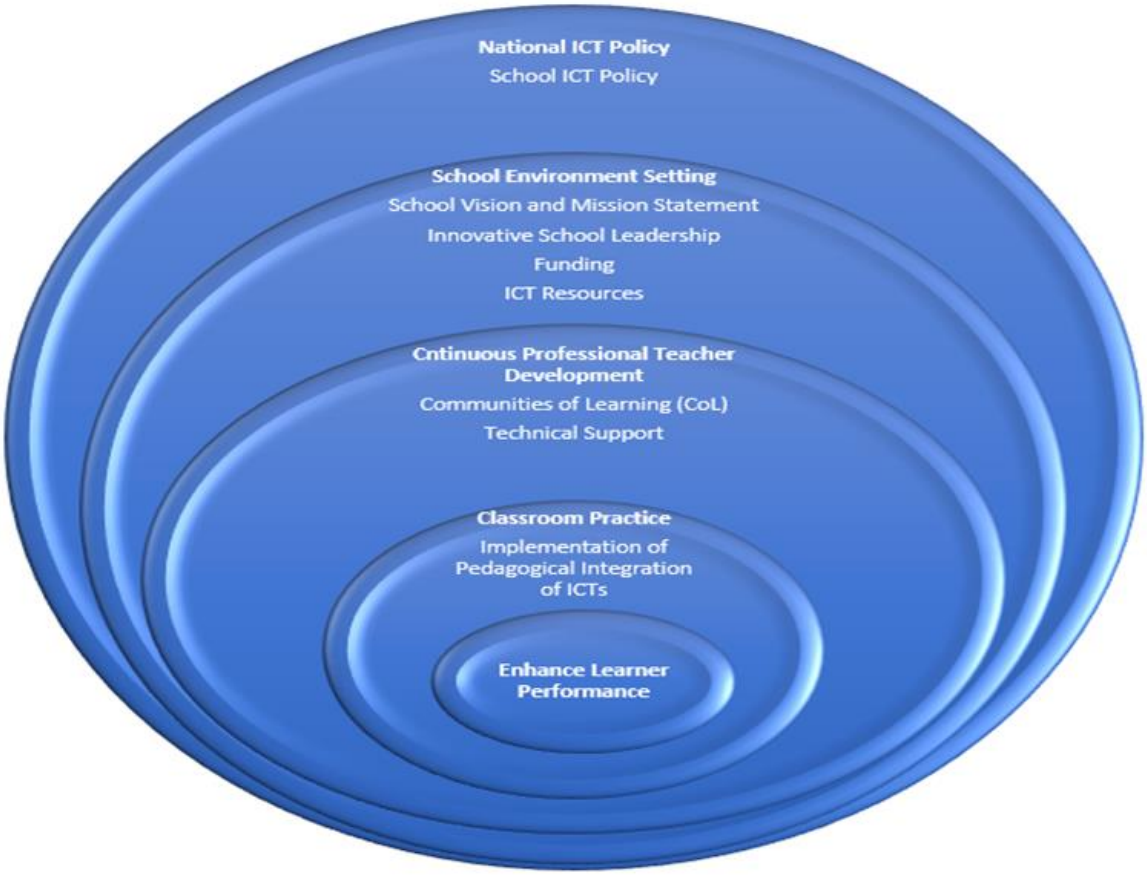

Figure 6 RISE Model (Resources, Infrastructure, Support, and Engagement

1. **Policy Framework:** The policy framework functions as a meticulously crafted blueprint that steers decision-making and operational activities within the realm of educational technology. It delineates precise guidelines and directives aimed at facilitating the successful integration of ICTs into pedagogical practices. Positioned as the outermost layer, often denoted as the principal layer, it articulates overarching principles that govern the implementation of ICT integration across various educational contexts. This framework typically comprises two key components: the National ICT policy, which furnishes comprehensive guidelines on a nationwide scale, and the school-level ICT policy, which adapts and operationalizes these guidelines to suit the unique context of individual educational institutions. By synergizing these policies, a robust foundation is laid for the effective integration of ICT in education, fostering the advancement of digital literacy, innovation, and equitable access to educational opportunities.

    - *National Policy*: The National Policy component of the framework advocates for a transition from the existing broad and generalized national policy to a more definitive and directive approach. Emphasizing the necessity for clear guidelines and unambiguous language, it aims to facilitate consistent interpretation and implementation across diverse educational contexts. This segment furnishes comprehensive and standardized directives for the integration of ICT across all educational institutions within a given country. Encompassing critical facets including infrastructure requisites, digital literacy benchmarks, curriculum alignment, and professional development strategies for educators, this policy establishes clear and pragmatic guidelines that underpin ICT integration initiatives in schools nationwide.

    - *School Policy:* In alignment with national policy directives, it is imperative for schools to formulate internal ICT policies that are tailored to their unique requirements and resource capabilities. At the institutional level, the policy framework undergoes adaptation and contextualization through the establishment of a school-specific ICT policy. Drawing inspiration from national guidelines, this policy is customized to accommodate the distinct needs, resources, and priorities inherent within the school environment. Typically, school ICT policies delineate actionable objectives, strategies, and implementation plans aimed at embedding ICT into pedagogical practices and learning environments. Serving as a guiding document, these policies offer a structured pathway for educators, administrators, and other stakeholders to

navigate, fostering coherence and consistency in the integration of ICT across educational endeavors.

2. **School Environment Setting:** The school environment setting plays a pivotal role in shaping the trajectory of successful ICT integration, as it encompasses a myriad of interconnected elements that directly influence the effectiveness and sustainability of technological initiatives. From setting the Vision and Mission statement, Innovative leadership, infrastructure capabilities to pedagogical approaches, administrative support, and professional development opportunities, each component within the school environment exerts a distinct impact on the integration of ICT into teaching and learning practices. Moreover, factors such as digital literacy levels among educators and learners, access to technology resources, and the alignment of ICT initiatives with broader educational goals further underscore the significance of the school environment in facilitating or impeding the seamless incorporation of technology within educational contexts. Consequently, a holistic understanding of these elements is essential for devising comprehensive strategies that foster a conducive environment conducive to the successful integration of ICT.

- *School Vision and Mission*: The framework emphasizes the importance of collective stakeholder engagement in establishing a shared vision and mission for ICT integration. This fosters widespread acceptance and commitment among educators, learners, and the community.
- *Innovative School Leadership*: School leaders play a pivotal role in driving successful ICT integration. The framework calls for innovative approaches to create accessible platforms for educators, regardless of financial constraints. This involves facilitating professional development, securing funding for resources, and exploring alternative funding methods.
- *Funding*: While resources remain a significant barrier to ICT integration in many schools, it is emphasized that there is a need for innovative funding approaches beyond traditional budget allocations can move beyond budget limitations and ensure the sustainability of their ICT integration efforts.
- *Adequate Resources*: The model underscores the need for readily available and well-maintained ICT resources within schools. This includes hardware, software, infrastructure, and ongoing technical support. Leaders must explore efficient resource allocation and consider innovative fundraising strategies.

3. **Continuous Professional Educator Development** - educator professional development serves as the critical engine driving the successful implementation of pedagogical integration of ICTs in educational settings. It highlights the dynamic and ongoing nature of professional development, emphasizing its crucial role in equipping educators with the necessary skills, knowledge, and confidence to effectively leverage technology within their teaching practices.

    - *Technical support:* the essential role of readily available and robust technical support in facilitating effective professional development programs and ongoing mentorship initiatives. By offering timely troubleshooting, resource assistance, and technology-specific guidance, technical support acts as a critical facilitator of educator learning and development. This support is particularly crucial for novice educators, enabling them to receive personalized guidance and feedback as they integrate ICTs into their teaching practices.

    - *Communities of Learning (CoL):* It emphasizes the importance of creating diverse and inclusive CoL that cater to the varying needs and preferences of educators. This may involve offering a range of formats, such as online forums, face-to-face meetings, and blended learning approaches. Moreover, it is crucial to cultivate a collaborative culture within the CoL, encouraging active participation, respectful dialogue, and mutual learning.

4. **Classroom Practice:** The classroom practice, situated as the penultimate layer within the framework of ICT pedagogical integration, serves as the crucible wherein theoretical knowledge and institutional directives converge into tangible educational experiences. It embodies the practical application of pedagogical strategies and ICT tools within the dynamic context of teaching and learning. Here, educators translate their acquired knowledge and skills into action, utilizing technology to facilitate interactive and engaging instructional experiences for learners. The effectiveness of classroom practice in integrating ICT is profoundly influenced by the interplay of elements from preceding layers within the RISE framework. Factors such as the clarity and specificity of national and school-level policies, the adequacy of infrastructure and resource allocation, the comprehensiveness of professional development initiatives, and the alignment of curriculum objectives with ICT integration goals collectively shape the landscape of classroom practice.

    - *Implementation of Pedagogical integration of ICTs*: The focus is on the actual implementation of pedagogical ICT integration within classrooms by educators. This stage builds upon the foundation laid by the outer circles, ensuring effective utilization of technology to enhance teaching and learning. Educators'

digital literacy levels, pedagogical competencies, and receptivity to innovation also exert a considerable influence on the extent and quality of ICT integration in the classroom. Thus, the classroom practice layer serves as a nexus wherein the cumulative impact of various elements from preceding layers manifests, ultimately determining the efficacy and transformative potential of ICT pedagogical integration in educational settings.

5. **Enhanced Learner Performance**: The innermost layer of the RISE model emphasizes the aim to achieve positive learning outcomes for learners through effective ICT integration. This final circle signifies the culmination of all efforts, leading to demonstrably improved academic performance and engagement.

This framework distinguishes itself by promoting contextually sensitive adaptation. Unlike standardized models, it can be applied to diverse school environments, irrespective of quintile status or geographic location. Its flexibility allows for customization based on individual school needs and resources.

7.4 Contributions of this Study

This study significantly contributes to the scholarly understanding of ICT integration in South African education by delving into several multifaceted critical dimensions. Firstly, the conceptual framework that was developed by the researcher (RISE) to incentivize pedagogical ICT integration, was developed based on the foundational work of Collis & van der Wende (2002) and their hypothesized model titled “Clusters of factors predicting current and future scenarios for ICT and educational delivery.” By adapting this framework to the South African context, the research was guided towards a structured exploration of the factors influencing pedagogical ICT integration in schools. Emphasizing elements such as clear policy direction, resource adequacy, tailored professional development, accessible technical support, and consistent monitoring, this model offered a structured approach to foster successful ICT integration.This framework not only provided a robust theoretical foundation but also served as a roadmap for formulating research questions and objectives, thereby facilitating a comprehensive investigation into the various sub themes associated with ICT integration in education Secondly, this study illuminates the landscape of educator digital competency, offering insights into their proficiency in ICTs and their capacity to effectively integrate technology into pedagogical practices. This analysis not only identifies areas necessitating further development and training but also underscores the imperative of enhancing educators' ability to leverage technology for instructional purposes. Thirdly, the research elucidates the influence of contextual diversity and the digital divide on ICT integration

within and between schools, delineating how resource allocation and educators' ICT skills shape implementation strategies and exacerbate existing disparities. This underscores the exigency of context-specific approaches tailored to bridge the gap and promote equitable access to technological resources. Additionally, the study critiques prevailing policy frameworks, exposing ambiguities in current ICT policies. This underscores the need for a revised policy framework equipped with clear implementation guidelines to foster effective ICT integration. Moreover, the study critiques the approach of school leaders, emphasizing the complacency observed among certain school managers in their support of ICT integration endeavors. It underscores the imperative for school leaders to adopt a proactive stance, acknowledging their pivotal role as facilitators of successful ICT integration. This entails advocating for the provision of educators with essential skills and knowledge during both pre-service and in-service training phases, thereby nurturing digitally adept learners.

7.5 Implications for this study

Within the domain of South African public schools, there exists an apparent disjunction between the White paper on e-Education (2004), South Africa's national ICT policy, advocating for the integration of ICTs and the practical utilization of such technologies by educators in schools. Despite the prevalence of theoretical models pertaining to ICT uptake in educational settings, there remains a dearth of empirical studies examining how educators within school contexts appropriate and apply ICT for pedagogical purposes. Notably, Jita (2016) has underscored the scarcity of research focusing specifically on the integration of ICT during teaching practice in schools. This scarcity is compounded by challenges faced by educators in implementing the pedagogical integration of ICTs in schools' due deficiencies in knowledge and skills. Consequently, South African educators lack confidence in utilizing ICT for pedagogical ends. Leveraging the affordances of the conceptual model offers a promising avenue for educators to identify suitable ICT tools aligned with pedagogical requirements. Through proactive measures such as staff development workshops and collaborations with ICT service providers, educators can bolster their competencies in ICT integration, thereby enhancing educators' exposure to and proficiency in utilizing ICT for learning purposes. Additionally, this research illuminates the crucial influence of contextual diversity and the persistent digital divide on ICT integration within and across South African schools. It highlights how unequal resource allocation and variances in educator ICT skills shape implementation strategies, further exacerbating existing disparities in access and utilization. This finding underlines the imperative for context-specific approaches that acknowledge and address these unique realities. Such approaches are crucial for bridging the digital divide and fostering equitable access to technological resources for all learners. Moreover, the refinement of ICT policies to provide clear directives on ICT integration in teaching and

learning is imperative, necessitating ongoing review and alignment with evolving educational trends and economic landscapes. However, the efficacy of ICT tools remains contingent upon their alignment with the contemporary teaching and learning milieu, a nexus where current software offerings often fall short. Consequently, educator training programs must pivot towards a pedagogically driven approach to ICT integration, prioritizing the cultivation of educators who can be adeptly guided towards the effective incorporation of ICT into their pedagogical repertoire.

7.6 Limitations to the study

This study acknowledges several limitations that impact the generalizability of its findings. Firstly, the limited sample size of four schools within one district and province restricts the ability to extrapolate these findings to the wider South African context. With only 16 participants representing diverse roles, their experiences might not reflect the full range of challenges and opportunities encountered by educators across the country. This case study approach offers valuable insights into specific school settings, but its generalizability remains limited.

Secondly, time constraints restricted direct observation of classroom practices, relying solely on participant interviews. While these offer valuable perspectives, they could be subject to recall bias or self-reported limitations. Additionally, focusing on one participant per phase within each school excludes the experiences of other educators, potentially creating an incomplete picture of ICT integration within those specific schools. The absence of classroom observations further hinders the ability to conclusively confirm the reported limited use of ICT for pedagogical purposes.

Despite these limitations, the study offers valuable insights from a specific context and lays the groundwork for future research. Acknowledging these limitations allows for responsible interpretation of the findings and emphasizes the need for further, broader-scale studies to investigate the complexities of ICT integration in South African schools.

7.7 Recommendations

Drawing from the insights garnered in this study, a set of nuanced recommendations emerge to fortify the efficacy of ICT integration within South African educational contexts:

To successfully integrate ICTs into South African schools, a multi-pronged approach is necessary. Firstly, collaboration among policymakers, educators, and service providers is crucial to revise the current ICT policy. This revision should tailor directives to diverse school contexts, align mandates with pedagogical needs, and establish clear guidelines for educational software in collaboration with ICT providers. Additionally, a robust monitoring system is key to identify challenges and make timely adjustments. Secondly, the revised policy must be crystal clear, offering definitive guidelines and quantifiable outcomes. This entails defining key terms, outlining

implementation strategies, and assigning unambiguous roles for all stakeholders (Isaacs, 2022). Thirdly, addressing resource scarcity is vital to ensure equitable access to technology across schools and regions. Increased budgetary allocations should prioritize devices, infrastructure improvements, and ongoing maintenance (Govender, Sikakhane & Maphalala, 2021). Fourthly, empowering educators through tailored professional development initiatives is essential. These initiatives should equip them with the necessary competencies to effectively integrate ICTs into their teaching (UNESCO, 2023).

Finally, effective communication strategies are needed to ensure all stakeholders are aware of the policies, their implications, and their assigned roles. This includes establishing regular communication channels, capacity-building workshops, and targeted awareness campaigns (Dlamini, 2023). By addressing these interconnected aspects, South Africa can create a successful policy framework for integrating ICTs into its education system, empowering educators, and learners for the digital age.

While recognizing the crucial role of policy and funding in ensuring equitable access to technology in South African schools, it is equally important to acknowledge the agency of school leaders in navigating resource limitations. Leaders can play a proactive role by fostering a culture of resourcefulness and exploring diverse acquisition options. One such initiative involves networking with the broader community to share Wi-Fi and data access, benefiting both learners and the wider community. Leveraging community partnerships, organizing creative fundraising events, and utilizing technology itself for crowdfunding campaigns are additional avenues. Building strong relationships with local businesses and organizations can yield valuable donations and sponsorships, while engaging the school community through events like tech-themed auctions or car washes can generate additional funds. Moreover, online platforms for crowdfunding campaigns can tap into a wider donor pool. By adopting a multifaceted approach to resource acquisition, schools can go beyond solely relying on policy interventions and empower themselves to actively bridge the digital divide. Furthermore, school leaders can foster a culture of responsible technology use within the community, encouraging knowledge sharing and collaborative learning opportunities beyond the traditional classroom walls. This collaborative approach, encompassing both internal and external resource acquisition strategies, empowers schools to take ownership of their technological integration journey and pave the way for a more equitable and digitally inclusive learning environment. Additionally, a crucial benefit of community involvement lies in its potential deterrent effect on potential theft or misuse of ICT resources, as increased community presence amplifies monitoring and oversight**.**

Securing adequate and sustainable funding for ICT resources remains a paramount challenge for effective integration in schools. Increasing dedicated departmental funding allocated to schools for acquiring, maintaining, and upgrading ICT equipment becomes a crucial first step. However, schools can adopt a proactive approach by diversifying their resource acquisition strategies beyond solely relying on government allocations. This includes fostering a culture of resourcefulness by exploring alternative funding avenues, such as establishing partnerships with local businesses and organizations, organizing creative fundraising events, leveraging online crowdfunding platforms, and securing sponsorships through mutually beneficial collaborations**.** Such a multifaceted approach empowers schools to become active participants in bridging the digital divide and fostering their own technological integration journey.

Collaborative Stakeholder Engagement: Active collaboration among education stakeholders, encompassing the Department of Basic Education, school leaders, educators, curriculum planners, education technology providers, and educator training institutions, becomes imperative. This collective effort aims to address challenges comprehensively and contribute to the development and implementation of sustainable ICT integration strategies. Ensuring ongoing, context-specific, and impactful ICT training for educators remains crucial, encompassing newly introduced technologies and ongoing updates to maintain proficiency. Moreover, a discernible digital disparity emerges among various cohorts of educators, necessitating tailored training initiatives aimed at bolstering the confidence and skillsets of older-generation educators. Ensuring equitable access to resources across educational institutions, irrespective of geographical location or ICT infrastructure status, is imperative to mitigate logistical hindrances. Cultivating a collaborative ethos and fostering knowledge exchange within educational settings can harness the complementary strengths of diverse generational cohorts, thereby optimizing the transformative potential of ICTs within an inclusive and technologically enriched learning milieu. Additionally, the implementation of an onsite technical support team, modeled after analogous structures in private sector enterprises, serves to expediently address and resolve technical impediments, thereby safeguarding uninterrupted and effective utilization of technological resources in educational contexts.

Developing a Generic ICT Framework: Policymakers should undertake a cross-disciplinary approach to analyse ICT integration across various subject disciplines. This endeavour aims to develop a generic ICT framework applicable to diverse areas of study, offering guidance on integrating technology within specific content and pedagogical approaches.

These comprehensive recommendations, when implemented strategically, hold the potential to address the identified challenges and propel South African schools towards a more successful and

sustainable model of ICT integration, thereby enriching the learning experiences of all learners. Additionally, considerations such as the role of research and development in elucidating effective models of ICT integration, ensuring sustainability through ongoing monitoring and resource mobilization, and addressing digital equity to ensure equitable access to technology and resources for all learners, remain pivotal for fostering a truly inclusive and technology-enhanced learning environment across South Africa.

7.8 Conclusion

This study investigated the implementation of ICT pedagogical integration in South African public schools, drawing insights from the research project titled "**Transforming Education through the implementation of ICT pedagogical integration: A case of ICT and Non- ICT schools in South Africa**". While the policy framework outlines a vision for technology-enhanced learning, our findings paint a complex picture of the current reality. The research reveals both strides and roadblocks in ICT integration. Educators recognize the potential of technology yet face numerous challenges. Resource disparities create a digital divide, with uneven access to hardware, software, and reliable internet connectivity. Skill gaps and limited professional development opportunities hinder effective technology use. The disconnect between policy directives and practical implementation remains a concern.

The journey towards seamless ICT integration requires a multi-pronged approach. Bridging the digital divide necessitates increased funding, innovative resource acquisition strategies, and equitable distribution of technologies. Skill development through targeted professional development programs, both pre- and in-service, is crucial for empowering educators. Context-sensitive policy guidelines, aligned with curriculum requirements and diverse school realities, are essential for effective implementation. Robust monitoring and evaluation systems with timely interventions can support sustainable practices. Cultivating a culture of collaboration among stakeholders – policymakers, school leaders, educators, technology providers, and the community – is key to collective action and shared responsibility.

Despite the challenges, the future of ICT integration holds immense promise. By addressing the identified obstacles and leveraging the existing momentum, South Africa can unlock the transformative potential of technology in education. Contemplate a future where learner-centered pedagogy flourishes, empowered by interactive tools and stimulating platforms. Envision educators, brimming with digital competence, seamlessly integrating technology into their instructional repertoire. Imagine classrooms transformed into egalitarian learning environments, where information access is unrestricted and digital literacy equips all learners to navigate the complexities of the 21st century. This vision is within reach. By building upon the findings of this

study, taking decisive action, and prioritizing equitable access and educator development, South African schools can embark on a journey towards a future where ICT integration empowers learners, enriches teaching, and transforms the educational landscape. The journey to this promising future begins now, with continued research, collaborative efforts, and unwavering commitment to harnessing the power of technology for the benefit of all learners.

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Appendix A: Ethics Approval

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Seegobin

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H22/01/30**
PROJECT TITLE	Exploring the implementation of ICT pedagogical integration in South African schools in response to the ICT in education policy
INVESTIGATOR(S)	Mrs T Seegobin
SCHOOL/DEPARTMENT	Wits School of Education/
DATE CONSIDERED	28 January 2022
DECISION OF THE COMMITTEE	Approved Risk Level: Minimal
EXPIRY DATE	27 February 2025

DATE 28 February 2022 **CHAIRPERSON** _____
(Professor J Watermeyer)

cc: Supervisor : Dr S Ndlovu and Dr A Dewa

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to submit an amendment of the protocol to the Committee. **I agree to completion of a regular progress report. For Minimal and Low studies, this is due annually on 31 December. For Medium and High Risk studies, this is due twice annually on 30 June and 31 December.**

_____ _____/_____/_____
Signature **Date**

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

Appendix B: Gauteng Department of Education Permission to conduct research

GAUTENG PROVINCE
Department: Education
REPUBLIC OF SOUTH AFRICA

8/4/4/1/2

GDE RESEARCH APPROVAL LETTER

Date:	**25 November 2021**
Validity of Research Approval:	**08 February 2022– 30 September 2022** **2021/362**
Name of Researcher:	**Seegobin T**
Address of Researcher:	**27 Koester Street**
	Birch Acres 3
	Kempton Park
Telephone Number:	**082 865 0416/ 072 423 2666**
Email address:	**tseegobin1@gmail.com**
Research Topic:	**Exploring the implementation of ICT pedagogical integration in South African schools in response to the ICT in Education Policy**
Type of qualification	**PhD**
Number and type of schools:	**4 Primary Schools**
District/s/HO	**Johannesburg East**

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.

25/11/2021

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. *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.*

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. ***Because of COVID 19 pandemic researchers can ONLY collect data online, telephonically or may make arrangements for Zoom with the school Principal. Requests for such arrangements should be submitted to the GDE Education Research and Knowledge Management directorate. The approval letter will then indicate the type of arrangements that have been made with the school.***
4. ***The Researchers are advised to make arrangements with the schools via Fax, email or telephonically with the Principal.***
5. *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.*
6. *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.*
7. *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.*
8. *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.*
9. *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.*
10. *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.*
11. *It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.*
12. *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.*
13. *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.*
14. *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.*
15. *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.*
16. *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

.....

Mr Gumani Mukatuni
Acting CES: Education Research and Knowledge Management

DATE: 25/11/2021

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 C: Consents from schools

School 1

ORANGE GROVE PRIMARY SCHOOL

26 November 2021

Re: Permission to conduct research at Orange Grove Primary School

I, Reuben Mufamadi, Principal of Orange Grove Primary School, give consent for research to be conducted at the school.

Permission is granted to **Tarishma Seegobin** to conduct research, on **"Exploring the implementation of ICT pedagogical integration in South African schools in response to the ICT in education policy"**

Yours in education.

R Mufamadi (PRINCIPAL)

ORANGE GROVE PRIMARY SCHOOL
P.O. Box 51411
RAEDENE
2124

DATE: 26/11/2021

PEMBROKE STREET, SYDENHAM, 2192
P.O. BOX 51411, RAEDENE, 2124. TEL: (011) 485-1803/4. FAX: (011) 485-3124
E-MAIL: admin@ogps.co.za

School 2

GAUTENG PROVINCE

LYNDHURST PRIMARY SCHOOL
Cnr Johannesburg and Kernick Road
Lyndhurst. Johannesburg 2192
Tel: (011) 4404913
lyndhurst@icon.co.za

09 December 2021

Re: Permission to conduct research at Lyndhurst Primary School

I, Wellington Shaw, Principal of Lyndhurst Primary School, give consent for research to be conducted at the school.

Permission is granted to **Tarishma Seegobin** to conduct research, on **"Exploring the implementation of ICT pedagogical integration in South African schools in response to the ICT in education policy"**

Yours in education.

(PRINCIPAL)

GAUTENG DEPT. OF EDUCATION
LYNDHURST PRIMARY SCHOOL
TEL: 011 440 4913 • FAX: 011 887 2078
2021 -12- 09
CNR. JRB & KERNICK ROADS • LYNDHURST
P.O. BOX 869050 • LYNDHURST • 2106
DISTRICT JE

School 3

BOVET PRIMARY SCHOOL

GAUTENG DEPARTMENT OF EDUCATION DISTRICT 9

P.O Box 49
Bergvlei
2010
☎011 882 1352
EMIS: 70015204 1

158 Vincent Tshabalala Rd
19th Ave, Alexandra
2090
🖷011 443 5525
✉: bovetprimary@gmail.com

Re: Permission to conduct research at Bovet Primary School

08 December 2021
Cell: 0825522259

I, Khensani Getrude Bilankulu, the principal of Bovet Primary School, give concert for research to be conducted at the school.

Permission is granted to Tarishma Seegobin to conduct research on **"Exploring the implementation of ICT pedagogical integration in South African schools in response to the ICT in education policy"**

Hope you will find this in order

K.G Bilankulu

Principal

GAUTENG DEPARTMENT OF EDUCATION
BOVET PRIMARY SCHOOL
P.O. BOX 49 BERGVLEI 2012
2021 -12- 08
TEL: (011) 882 - 1352 FAX: (011) 443 - 5525
Email: bovetprimary@ymail.com

School 4

education
GAUTENG PROVINCE

DR MATHOLE MOTSHEKGA PRIMARY SCHOOL

496 CNR FALCON & RIET DUIKER STR
P.O. BOX 17855
RABIE RIDGE, 1688/1685
Email address: info@drmatholemotshekgaprimary.co.za
Principal: Mrs Sebola N
Tel: (011) 3101797/75 Cell No.: 082552 7944

PRIMARY SCHOOL

01 December 2021

Re: Permission to conduct research at Dr Mathole Motshekga Primary School

I, N Sebola, Principal of Dr Mathole Motshekga Primary School, give consent for research to be conducted at the school.

Permission is granted to **Tarishma Seegobin** to conduct research, on **"Exploring the implementation of ICT pedagogical integration in South African schools in response to the ICT in education policy"**

Yours in education.

(PRINCIPAL)

DR MATHOLE MOTSHEKGA PRIMARY SCHOOL
REG NO.: 700400080
TEL: +27 (0) 64 574 1051 | +27 (0) 74 914 5494
ADMIN
23 SEP 2022
496 CNR FALCON AND RIETDUIKER STREET, RABIE RIDGE, MIDRAND, 1685

Appendix D: Consent forms

I

CONSENT FORM

Please fill in and return the reply slip below indicating your willingness to be a participant in my voluntary research project.

Title of project: Exploring the implementation of ICT pedagogical integration in South African schools in response to the ICT in Education policy.

Name of Researcher: Tarishma Seegobin

I, _____ agree to participate in this research project. The research has been explained to me and I understand what my participation will involve.

Permission to be recorded

I agree to be recorded during the interview	YES/NO
I know that the recording will be used for this project only	YES/NO

Permission to be interviewed

I would like to be interviewed for this study.	YES/NO
I agree that my participation will remain anonymous	YES/NO
I agree that the researcher may use anonymous quotes in her research report	YES/NO
I agree that the information I provide may be used anonymously by other researchers following this study	YES/NO

Informed Consent

I understand that:

- my name and information will be kept confidential and safe and that my name and the name of my school will not be revealed.
- I do not have to answer every question and can withdraw from the study at any time.
- I can ask not to be recorded, photographed and/or videotape
- all the data collected during this study will be destroyed within 3-5 years after completion of my project.

_____ _____

Signature Date

Appendix E: Interview schedule

Manager

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

I

Manager Interview schedule

Number of learners in the school: Male _____ Female _____ Total _____

Number of SMT members: Male _____ Female _____ Total _____

Number of Educators: Male _____ Female _____ Total _____

Technological Resources Available and quantity:

_____

_____

1.1 What ICT policies does the school have? Briefly highlight some of the contents in this/ these policies and how they are implemented at your school?

_____

_____

1.2 What ICT facilities/ opportunities does the school have for learners and who funds these? _____

_____

2.1 What do you understand by the term ICT integration? _____

_____

_____

2.2 Do educators have access to the computers for teaching and learning purposes? Is so, how do they use ICTs for teaching and learning?

_____

_____

_____

2.3 In your opinion (as a manager), what are the major barriers hindering the achievement of your school's ICT-related goals for learners?

_____

2.4 To what extent does management influence the pedagogical integration of ICTs in school?

3.1 Does the entire school have Wi-Fi? _____

3.2 What are the challenges facing connectivity at your school and how are these challenges resolved? _____

4.1 How is your school assisted with technical support? _____

4.2 What challenges do you experience regarding technical support? _____

5.1 Have you had any ICT training? _____

5.2 Briefly describe the kind of training in ICT you have had and how has it impacted on your work? _____

5.3 What type of training has the educators undergone in order to facilitate ICTs in their teaching and learning? _____

5.4 Describe the impact of ICT on professional development/continuing education programs for employees from your institution. _____

6.1 What do you think about ICT integration in the classroom? Is it beneficial? Explain...How would you motivate educators to integrate ICTs in their teaching and learning? If educators undergo training, do you think that ICT integration would work in this school? _____

7.1 What structures does the school need or have to be put in place for successful implementation of pedagogical integration of ICTs in your school?

Educator

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

EDUCATOR INTERVIEW SCHEDULE

Name of school: _____ Grade taught: _____

Subjects: _____

1.a) Do you have access to a computer in your school? _____

1.b) Do you have access to a computer out of school? _____

2.a) Are you aware of the ICT policy in education (White paper on e-Education, 2004)? _____

2.b) To what extent are you implementing the ICT policy in pedagogy? _____

_____

3. What type of training have you attended to develop your level of skills/ competencies in ICT integration? Has the course attended been beneficial?

_____

_____

3.a) Were you able to apply what was learnt to your teaching?

_____

3.b) What do you understand is meant by pedagogical integration of ICT?

_____

_____

3.c) Describe the various ways that you use ICT for teaching purposes.

_____

3.d) Which software/ programmes do you use for planning, teaching, marking etc.? _____

_____

_____

3.e) Describe any impact that ICT has had on your planning, teaching, and learning. _____

_____

_____

3.f) Describe the impact that ICT has had on learners' learning? _____

_____

4.) What factors either hinder or promote the pedagogical integration of ICT in your school?

_____

5. What skills/ competencies do you have &/ or require to effectively integrate ICTs in your teaching?

_____

_____

6. What are the challenges you experience using ICTs in your subject/ teaching?

_____

7. Do you receive adequate technical support to ensure a smooth ICT integration process? (If yes, what kind of support do you receive? If no, what kind of support do you need to ensure a successful integration process?)

_____

_____

_____

8. Are there adequate resources (infrastructure, connectivity, software) available to successfully integrate ICT?

_____

_____

9. How do you perceive ICT integration in your teaching and learning? (Explain)

_____

_____

Appendix F: Turnitin report

Tarishma PhD Thesis Final _ 11 March 2024.docx

by Test student

Submission date: 12-Mar-2024 07:54AM (UTC+0200)
Submission ID: 2318391042
File name: Tarishma_PhD_Thesis_Final__11_March_2024.docx (989.06K)
Word count: 71709
Character count: 455211

Tarishma PhD Thesis Final _ 11 March 2024.docx

ORIGINALITY REPORT

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