



**Newly qualified in-service teachers' readiness for pedagogical
technology use in the classroom: case studies of township schools**

By

Naledi Vilakazi

(1434130)

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Supervisor: Dr. Alton Dewa

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Dedication

To my precious children, whose fleeting presence left an indelible mark on my soul, I dedicate this thesis to you with all the love that resides within me. May this dedication serve as a testament to the everlasting bond we share.

Acknowledgement

Without God, this research would not have been possible.

To all those who had a helping hand in my research, I sincerely treasure your contributions, be it small or big. Thank you for your unlimited support, wisdom, never-die attitude and for giving me a reason to go on. Thank you for being my sunshine on cloudy and dark days.

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Declaration Of Original Work

I Naledi Vilakazi certify that this research report titled *Newly qualified in-service teachers' readiness for pedagogical technology use in the classroom: case studies of township schools* is my original work except where citations and acknowledgements indicate otherwise is my original work and has never been submitted before.



Naledi Vilakazi

Date: September 2024

Abstract

Newly qualified teachers in South African townships face a critical challenge: integrating technology effectively into classrooms to prepare learners for the demands of Education 4.0 and the Fourth Industrial Revolution (4IR). Education 4.0 and the 4th Industrial Revolution (4IR) necessitate seamless digital technology integration, yet many teachers lack the skills and knowledge to leverage its potential (Oke & Fernandes, 2020). The study aims to investigate the preparedness of newly qualified in-service teachers in township schools for integrating pedagogical technologies into their classrooms. By using case studies, the research explores the factors influencing their readiness for effective technology use in the learning environment. The study uses a qualitative method for data collection, specifically in-depth interviews, to explore teachers' perspectives on technology integration. Purposive sampling was employed to select six teachers from township secondary schools, ensuring rich and relevant data collection (Creswell, 2013). Thematic analysis revealed a complex landscape marked by uneven adoption of digital tools, inadequate teacher training, and limited resources. The findings exposed this mismatch; the Activity Theory highlighted the contradictions faced by the newly qualified in-service teachers – they are expected to integrate technology yet lack the tools and knowledge to effectively mediate student learning activities with technology as an object. This research offers valuable insights for policymakers and educators. The study recommends the creation inclusive learning environments that consider the socio-economic realities of township schools and teacher training programs with pedagogical approaches that utilize technology for transformative learning.

Key Words: Digital Technologies, Digital Pedagogical Affordances, Communities of Practice, newly qualified-In-Service Teachers, Forth Industrial Revolution, Professional Development

List of Abbreviations and Acronyms

DBE	Department of basic education
DOE	Department of education
ICT	Information communication technology
CAPS	Curriculum and Assessment Policy Statement
NQT	Newly Qualified Teachers
MRTEQ	Minimum Requirements for Teacher Education Qualifications
OECD	Organisation for Economic Co-operation and Development
NEDP	National Education Development Plan
AT	Activity Theory
CoP	Community of Practice

Definitions of the key concepts/terms

Key definitions crucial for understanding this study are outlined below. These concepts and terms have been carefully curated to offer clarity regarding their connotations within the context of this research. Providing a comprehensive understanding of these terms empowers the reader to gain insight into how these terms are interpreted and conceptualized within the study's framework.

Teacher: A teacher is an individual entrusted with the responsibility of facilitating the acquisition of knowledge, competencies, skills, and values among learners

Digital technologies: Digital technologies encompass a wide array of electronic devices, software applications, and online platforms designed to facilitate the creation, sharing, and storage of information (Selwyn, 2016).

Information Communication Technology (ICT): ICT refers to the comprehensive range of technologies that enable the transmission, reception, and manipulation of information through telecommunication systems. This includes hardware devices, software applications, and communication media utilized to access, process, and disseminate information effectively (Evoh.2007).

Newly qualified educator in the 4IR (Fourth Industrial Revolution) terrain: An educator who has completed their formal education and training to become certified teachers specifically within the context of the Fourth Industrial Revolution. A recent graduate (less than 28 years old) who have recently graduated.

Education 4.0: refers to a modern educational paradigm aligned with the Fourth Industrial Revolution (4IR). It emphasizes the integration of digital technologies, personalized learning experiences, problem-based learning, and diverse assessment methods. Education 4.0 aims to prepare learners for the rapidly evolving demands of the digital age.

Pedagogical Technology: This is the type of knowledge, that is intertwined with the knowledge of the art of teaching that is a prerequisite for any educator who have been trained for teaching and the knowledge required for the use of teaching in the classroom.

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Chapter One: Study Overview

1.1 Introduction

Pedagogical technology is being embraced at varying rates by classrooms all over the world, creating a constant change in the digital landscape of education. Township schools in South Africa can bridge socio-economic gaps through the integration of technology and equip learners with vital 21st century skills through its integration of technology. In spite of this technological advent, questions remain regarding how ready teachers are to navigate this rapidly evolving terrain. An examination of newly qualified in-service teachers in township schools is explored in this study, in order to determine their readiness for using pedagogical technology in the classroom. By examining rich case studies, we shed light on the challenges and opportunities teachers face when attempting to utilize technology in the classroom, providing valuable insights that can be used to inform teacher training, resources allocation, and support structures in such a critical context (Mabaya & Moloi, 2023; Mots'habi & Ramorwedi, 2023). By exploring the nuances of their experiences, we aim to pave the way for a future where technology serves as a transformative tool for both teachers and learners within South African township schools.

This paragraph introduces the research topic by setting the scene in the evolving landscape of pedagogical technology adoption, particularly in the context of South African township schools. It highlights the specific focus on newly qualified teachers and the role of case studies in illuminating their readiness. Finally, it emphasizes the potential impact of this research on informing teacher training, resource allocation, and ultimately, creating a future where technology empowers both teachers and learners.

1.2. Background of the study

Newly qualified in-service teachers in South African township schools confront a unique challenge: integrating technology into their daily pedagogy (Mahlo & Waghid, 2023). While excited about the potential of digital tools to engage learners and bridge socio-economic gaps, they often grapple with a multitude of obstacles, as our case studies have revealed (Mabaya & Moloi, 2023)). Lack of adequate training and experience with technology leave them feeling ill-equipped, hesitant to navigate unfamiliar software and troubleshoot technical glitches. As per Mahlo & Waghid (2023) the lack of training for pedagogical technology in school remains as a capital contributing to the limited use of technology for integration and implementation in teaching and learning. Limited access to reliable internet and insufficient classroom computers

further exacerbates these anxieties, creating an environment where frustration often outweighs the promise of innovation (Gordon, 2023).

Already burdened by under-resourced classrooms and socio-economic challenges, South African township teachers face an additional hurdle in their quest to deliver impactful education: the ever-evolving landscape of technology-driven pedagogy. As Mkhize et al. (2020) highlight, the pressure to meet curricular demands and manage heavy workloads leaves precious little time for these teachers to explore and implement innovative lesson plans and pedagogical approaches that leverage the potential of technology. This stifles their ability to cater to the diverse needs of their learners in the face of a rapidly changing world, potentially exacerbating existing inequalities. In essence, the very tools that hold the promise of transforming education in South African townships risk becoming yet another burden, unless concerted efforts are made to address the time constraints and resource limitations faced by these dedicated teachers. Understanding these challenges, as our case studies illuminate, is crucial for designing targeted support systems, building robust professional development programs, and ensuring equitable access to resources, thus empowering these promising teachers to embrace the transformative potential of technology for their learners and their own teaching journeys.

ICT pedagogical strategies offer multiple affordances that promote effective teaching and learning (Dlamini & Nkambule, 2020). These approaches support flexible learning environments important to learners in the 21st century compared to traditional teaching (such as the chalkboard method, talking and textbook- which are teacher-centred). Ultimately presenting opportunities towards developing self-determined, autonomous learning which provides avenues of learning new information from online personal settings which are not possible in traditional teaching (Blaschke, 2019). 21st-century learners, those shaped by the omnipresence of digital technology, have fundamentally different expectations about their education than previous generations. Far from passive receptacles of information, they crave classrooms that mirror their online lives, buzzing with interactivity, collaboration, and personalized learning (Bakhtiar & Yousaf, 2020). They expect lessons to be dynamic and engaging, harnessing the power of virtual reality simulations, gamified learning, and AI powered feedback to cater to their individual learning styles and paces (Honey et al., 2022). For them, learning is not confined to textbooks and lectures, but rather a boundless exploration fuelled by instant access to information and diverse perspectives through online platforms and

social networks (OECD, 2020). They demand teachers who are not just subject-matter experts but digital guides and facilitators, adept at navigating the ever-evolving tech landscape and fostering a collaborative learning environment where knowledge is co-created and shared (World Economic Forum, 2020). In short, 21st-century learners yearn for a classroom that is less about rote memorization and more about critical thinking, problem-solving, and lifelong learning, where technology empowers them to become active participants in shaping their own educational journey.

With the rise and expansion of education 4.0 in the global scale, teachers are encouraged to foster practices inclusive of education 4.0 terrain, especially the newly qualified teachers. However, there is limited evidence that they are pedagogically integrating technology into their lessons (van Wyk & Waghid, 2022). Since they are newly qualified from teacher training institutions, it is expected of them to be knowledgeable in the use of digital technologies, a skill necessary in the 4IR teaching terrain. The problem is, “not all teachers are well-trained on how to teach those skills to the learners, especially when they also have to integrate technology in their teaching as well” (Shafie, Majid & Ismail, 2019, p.26). Teaching using 4IR platforms provide affordances that learners need such as simulation and modelling (Maringe & Chiramba, 2022).

Appropriate technology implementation in the classroom provides efficient pedagogical strategies - a ladder that leads a learner to the foundation of learning (Dlamini & Nkambule, 2020). According to van Wyk & Waghid (2022) to adapt to the 4IR, learners need skills to create, operate and collaborate with the new technology, these include technical, entrepreneurial, soft and workforce preparedness. For purposes of this study, the use of these pedagogical approaches coupled with ICTs are viewed as practical educational instruments that promote learning activities. Of considerable importance to this study are the pedagogical approaches that include autonomy, openness, connectedness and diversity which foster the type of learning required in the 4IR terrain.

Autonomy as articulated by Oates (2019) means self-sufficient. The concept of autonomy in education originates from a motivated learning theory outlining the proactiveness in pursuing one's own learning objectives and taking charge of the learning process. As Yong Zhao (2023) aptly states, "the 4IR demands individuals who can think for themselves, solve problems

creatively, and adapt to unforeseen challenges" (p. 12). This necessitates moving away from teacher-centric models and embracing learner-driven approaches like inquiry-based learning. By posing open-ended questions and encouraging exploration, teachers can nurture a sense of ownership over the learning process, fostering critical thinking, self-directedness, and a thirst for knowledge (Kwon et al., 2023). This autonomy empowers learners to become independent problem-solvers, unfazed by the uncertainty inherent in the 4IR. For learners of 4IR classes, this creates opportunities for interactive systems of learning such as collaborative learning through an online community that is made feasible with the aid of technology and space created by a teacher who is actively engaged using digital technology. Thus, incorporating pedagogical technology in everyday learning by newly qualified teachers promises an exciting journey of exploration and growth for learners, preparing them for their future careers.

Openness shatters the confines of the classroom walls, embracing the boundless knowledge and diverse perspectives that exist beyond the traditional curriculum. Open educational resources (OERs), freely available online, provide learners with a treasure trove of materials, allowing them to personalize their learning journeys and explore topics beyond the limitations of textbooks (Bates, 2024). Additionally, fostering global collaboration through virtual exchange programs and international projects broadens learners' horizons, challenging their assumptions and preparing them for a world increasingly defined by interconnectedness and cultural exchange. Openness in pedagogies that are lobbying for 4IR teaching means that courses, learning materials, and evaluation all contribute to the accessibility of knowledge. This can be described as the accessibility of these resources regardless of any limitations imposed by economic, social, legal, or technological constraints (Tahir, Ahmad, Hamid, Zamri, Arsat & Rahmat, 2021). Living in a high-tech society requires teachers to live outside the walls of their classrooms. This means that teachers should collaborate to create meaningful diverse and inclusive pedagogies for their teaching and learning.

Connectedness transcends physical proximity, demanding the ability to collaborate effectively in both virtual and real-world settings. Blended learning environments, seamlessly integrating technology and face-to-face interactions, provide platforms for asynchronous and synchronous collaboration, fostering teamwork, communication skills, and the ability to co-create knowledge (Fullan & Hargreaves, 2024). These collaborative skills are crucial in the 4IR, where complex problems require diverse perspectives and the ability to work effectively within teams.

Finally, diversity is not just a buzzword, but a vital element of 4IR learning. Culturally responsive pedagogy, as Nieto & Bode (2024) emphasize, "recognizes and values the unique backgrounds and experiences of each learner, incorporating them into the learning process" (p. 17). By creating inclusive classrooms that celebrate differences and dismantle unconscious biases, newly qualified teachers can foster innovation and creativity, as diverse perspectives lead to a richer tapestry of solutions and a deeper understanding of the world around us.

In conclusion, the 4IR demands a transformative approach to education, one that prioritizes autonomy, openness, connectedness, and diversity. By weaving these threads into the fabric of learning, newly qualified teachers can equip individuals with the critical thinking, collaboration, and adaptability needed to navigate the complexities of the 4IR. As Zhao (2023) concludes, "the future belongs to those who can learn to learn, adapt to change, and embrace the unknown" (p. 15). And it is through these pedagogical approaches that we can empower learners to become not just citizens of the 4IR, but architects of a future shaped by innovation, collaboration, and a celebration of human diversity.

4IR Skills and their role in pedagogical techniques

4IR is the acronym of the fourth industrial revolution. The 4IR skills are what is expected, for the 21st Century, and they prepare learners for future careers. The fourth industrial revolution comes in an era where teachers, especially older teachers, experience a lot of difficulties with resolving the gap of transformative pedagogical approaches. It is largely prevalent to the younger generation, who are techno-savvy and largely digital native. The 4IR has created a landscape that requires schools to prepare learners to face the challenges of the 21st century, including those presented by quantum computing and internet of things, coding and robotics. Teaching in 4IR means that teachers and their pedagogies are subsequent to the new generation of learners. Essentially what this means is that teaching should avoid trial and error and instead include critical thinking skills techniques and inquiry-based teaching to foster 4IR skills.

The South African government has determined that it is vital to match its educational system with worldwide trends of embracing technological innovations and developing new Artificial Intelligence (AI) based technology. The new curriculum tends to teach learners with an understanding about coding and robotics while developing their skills and competencies to prepare them for the future workplace. According to a study by Penprase (2018), the 4IR

revolution will shape the future of education, and work and accelerate workforce reskilling. In 2021, the government rolled out the coding and robotics workshops per district and teachers were trained to be implementers on the new teaching software to be added to their pedagogies so as to align with the 4IR worldwide trend. However, newly qualified teachers who are somewhat closer to the 4IR terrain seem not to be teaching the skills that promote learners for 4IR space in their lessons.

Learners graduating from educational institutions have a weak background knowledge towards the use of digital technologies in classrooms (Yu, 2022). Most South African schools particularly, affluent one's expert teachers to use digital technology in their teaching practice. Nevertheless, the majority of learners have rudimentary knowledge towards the use of digital tools, hence affecting their teaching and learning. There seems to be inadequate training in the use of technology by their methodology lecturers. Depending on the current technology and Pedagogical Content Knowledge (PCK) expertise of each teacher, a change in teacher technological knowledge takes a varying period of time. In terms of using technology in the classroom, fewer programs indicated that graduates will effectively incorporate assistive/adaptive technology to serve special needs (18% strongly agreed; 61% somewhat agreed) (Kleiner et al. 2007). This research chose newly qualified teachers because the contemporary would be affected by 4IR requirements. Politicians and government officials are lobbying for learning-focused instruction for 4IR, especially with the incoming teachers.

1.3. Problem statement

Readiness

There is limited use of ICT integration in teaching and learning during classrooms by newly qualified in-service teachers to prepare learners for the 4IR terrain (Yu, 2022). Educating the “net generation” of learners requires technological pedagogy that facilitates practical and effective learning (constructivism and pragmatism). John Dewey theory states that

suggested that for effective learning to be realised, it should be implemented through social interactions with the environment and the school setting should be a social institution whereby learners interact physically or through the use of digital technologies (virtually) (Williams, 2017).

Despite the proposition of John Dewey's philosophy of pragmatism newly qualified in-service teachers rarely use digital technology for pedagogical instruction in their practice (Shafie et al, 2019). The teaching method seems to be a misfit in the 4IR space, it is just like putting a round peg in a square hole. Technology platforms provide affordances in teaching and learning as they have inherent simulation and modelling properties. Teaching using simulation and modelling enhances learner understanding of the concept taught (Maringe & Chiramba, 2022). According to Chernikova, Hitzmann, Stadler, Holzberger, Seidel & Fischer (2020), "simulation-based learning offers a wide range of opportunities to practice complex skills in higher education and to implement different types of scaffolding to facilitate effective learning" (p. 499). A similar approach can be used in high school, where simulation can be used to facilitate critical thinking, problem-solving and collaboration to help learners acquire domainspecific knowledge and skills about the learned concept. This research intends to examine how newly qualified in-service teachers in township schools specifically in Gauteng are hesitant/reluctant to include using digital technology in their teaching practice. Furthermore, it proposes possible solutions that may help in-service teachers to integrate digital technology into their teaching. This includes appropriate training and workshops that align with pedagogical use of technology integration in the classroom.

The increase of digital technology in educational institutions has disrupted the pedagogical methods of teaching and learning. Due to the necessity to change instructional standards and regulations teachers are expected to teach using digital technology. However, despite the widespread use of these digital technologies, new qualified teachers still face some challenges, such as applying these technologies in their classroom practice. Additionally, newly qualified lack the mindset necessary to embrace digital tools for new teaching and learning processes as game changers (Ayanwale, Ndlovu, Oladek, 2022). They need to change the instructional standards and regulations because according to Ruminar & Gayatri (2018) education is changing from pedagogy into heutagogy, which means that learning should be self-determined and should emphasise autonomy, capability and capacity. As a result, teachers should shift from acting as directors and start acting like facilitators. Technology echoes this as a learning formula that subscribes to connectivism.

1.4. Aim of the study

The aim of the study was to explore newly qualified in-service teachers' readiness for pedagogical technology use in the classroom using case studies of township schools.

The objectives of the study were to:

examine the integration of digital technologies by newly qualified in-service teachers in the classroom. Explore teachers' capabilities to facilitate the acceleration of digital classrooms that were conducive or enablers for the 4IR skills.

1.5. Research Question

Despite having the qualifications and access to 4IR resources, why do newly trained in-service teachers adopt/use technology in their practice so slowly?

Sub-research questions

1. How do newly qualified in-service teachers integrate digital technology in their pedagogy?
2. How well-prepared are newly qualified in-service teachers in the use of digital technology?
3. What strategies could newly qualified in-service teachers use to accelerate the integration of digital technology in the classroom?

1.6. Rationale of the study

Industry 4.0's rise of technology has encouraged education to alter the rules and expectations of learning. Education 4.0 is a response that is aligned with the needs of 4IR and employs a variety of ICT tools to advance teaching and learning in the 21st century. Newly qualified teachers experience multiple hindrances in accelerating the use of technology due to the demands of Education 4.0. According to van Wyk & Waghid (2022) education 4.0 aims to prepare pre-service teachers for a changing and dynamic learning environment in which learning can take place anywhere, is personalised, includes problem and project-based learning, and has a wide range of assessment methods. Knowledge and skills are essential in this day and age to stay current and competitive. As part of education 4.0, concepts like reskilling and upskilling have been developed. This includes learning creative skills, interactive teaching methods, and cross-disciplinary perspectives, which eventually replace the emphasis on learning to transfer disciplinary material. The ability to adapt to the accelerating rate of technological development, particularly in the educational sector, is crucial for a transfer of 4IR skills. Such a curriculum should be evident in most township schools of South Africa as it resonates with the UNESCO ICT Competency Framework for Teachers and other ICT policies.

In today's society, continuing traditional education is counterproductive to the tech-savvy internet generation. Dewey believed that progressive education should encourage learners to expand their knowledge through social interactions and classroom environments that emphasise learner-centred rather than teacher-directed activities (William, 2017). The incorporation of digital technologies for teaching and learning should serve as a facilitator for such an interactive and dynamic approach to learning. For this reason, it is critical that newly qualified teachers urgently adopt 4IR skills and technologies into classroom practice. As a result, learners would be better prepared to adhere to the standards of the 4IR terrain and future employment.

One of the priorities in South African Education is the provision and implementation of digital technologies in schools to achieve the National Development Plan (NDP) objective of 2030. The current focus in implementing this is the provision of infrastructure and resources to support teacher pedagogies in the classroom for transformative learning geared towards 4IR skills (Marr, 2019). Despite the Department of Basic Education (DBE) policies of ICT integration and strategies for digital classrooms, most in-service teachers are still lagging in integrating educational technologies in their classrooms. In the pool, of these in-service teachers is a group of newly qualified teachers who were exposed to technology in higher education institutions.

Although teachers have some fundamental technological knowledge, less than 10% of teachers are adept in technology, according to Shambare, Simuja, and Olayinka's research from 2022, despite the fact that most of them have some basic expertise (Shambare, Simuja & Olayinka, 2022). Transformative pedagogies, in accordance with the professional development framework for digital learning, involves deeper levels of pedagogical practice, learner centeredness, and the application of higher-order thinking abilities created by using digital technology to facilitate deep learning. This study, therefore, relied on recently graduated Inservice teachers who had been taught about learning theories and policies that supported the use of digital pedagogical approaches and technology to prepare learners for the 4IR terrain.

1.7. Significance of the study

The study shed some light on the preparedness of newly qualified in-service teachers in the use of digital technologies for 4IR skills. The insights from this study provided much-needed evidence about the level of digitally aligned pedagogies that newly qualified teachers use in

their teaching practice, and recommendations that could be adopted to prepare pre-service teachers for transformative technological pedagogies for the techno-savvy generation. Further to this, the study contributed relevant findings that may raise awareness to the educational development unit in South Africa about the level of competencies of newly qualified in-service teachers. Furthermore, inform the mapping of training programs of 4IR skills integrative of digital technologies for teachers beyond the hindrances faced by the township school teachers.

Chapter two: Literature Review

2.1. Introduction

To help answer the main research question, this section reviewed what other scholars said about the integration of technology in the classroom in an environment propelled by 4IR, especially by newly qualified teachers employed in township schools.

It is necessary to clarify concepts critical in understanding the literature reviewed in the study, the kind of learning which the study focuses on, is embedded in the use of technology. 21 century skills are the kind of skills that necessitate this kind of learning, according to (Laar, Deursen, Dijk & Haan, 2017) 21 century skills involve process that require ICT in collaboration with how someone thinks, solves problem, and learns so as to be able to function effectively in a technologically rich society. The current period in society further calls this, 4IR skills, which demand the mastery of ICT application to solve cognitive tasks at work and produce higher order thinking processes (Laar, Deursen, Dijk & Haan, 2017). It is further indicated in the study by Kamaruzaman, Hamid, Mutalib & Rasul (2019) that the impact of 4IR skills on jobs is determined by skill level, when the skills of an individual no longer meet the skills required by jobs, unemployment among graduates may occur, the situation becomes worse when the existing skills are no longer in line with the technological developments in 4IR. In an effort to ensure that every individual can work in a 4IR setting, they have to develop a set of skills that will make them able to satisfy future jobs market. Similarly to learning, teachers of the 4IR terrain should employ blended approaches of learning which include technology enhanced instruction so as to align learners with the future of work. Technology-enhanced instruction

2.2. Teaching in the 4IR space

The Fourth Industrial Revolution (4IR) is characterized by the convergence of technologies that blur the lines between the physical, digital, and biological spheres (Schwab, 2016). This technological revolution has profound implications for education, requiring a shift towards teaching and learning that equips students with the skills and competencies needed to thrive in a rapidly changing world. South African physical science teachers, in particular, are faced with

the challenge of preparing students for the 4IR, which demands a deep understanding of scientific concepts, problem-solving abilities, and technological literacy.

Huynh & Nguyen (2021) believe that teachers should properly integrate different technologies into the curriculum appropriately, particularly in light of the inclusion of 4IR skills. Teachers need to understand how to include each of these elements in high-quality early learning. Newly qualified teachers should create a conducive space for the atmosphere of change to foster an environment where change may be realised (Maringe & Chiramba, 2022). Recent research has shown that implementing digital pedagogies in the classroom is essential to establishing a successful learning environment (Blaschke, 2019). Participants in another study, felt that using interactive digital systems provided a more collaborative aspect to learning than using a stagnant approach for integrating digital technologies in the 4IR terrain (van Wyk & Waghid, 2022).

2.3. Knowledge and skills required by teachers in the 4IR terrain.

Teacher training plays a significant role in preparing teachers with 21st-century skills. Newly qualified in-service teachers are expected to demonstrate these skills in their teaching practice. Maringe & Chiramba (2022) refer to a list of the skills required of teachers in the 4IR terrain, and they believe that understanding the role of 4IR and adequate knowledge of different 4IR components, such as autonomous robots, simulations, horizontal and vertical integration, internet of things, and augmented reality, should be the starting point. This web of knowledge and skills is not limited to the ecosystem of strict learning methods, but recognizes sophisticated connected platforms, networks, and data analytics necessary to understand the learning needs of learners.

Contrary to the study's expectations, the findings showed that teachers and tutors lack the necessary knowledge development skills and integration capabilities for new digital technology innovations. While 4IR teaching becomes popularly learner- centred, Huynh & Nguyen (2021) propose for cooperative teaching as a predominant area of expertise for newly qualified in-service teachers. This is where the student collaborates with teachers and assistive technologies to achieve a learning objective. The concept of problem-based learning can be described as a pedagogical approach that enables learners to learn while engaging actively with meaningful problems. In the case of digital technologies which include technologies used for teaching and learning, learners and teachers may adopt strategies that are enablers for this approach to

learning. Thus, multimodality is imperative within 4IR as a blended approach to learning where face-to-face class/contact time and educational-enhanced learning methods are integrated (Huynh & Nguyen, 2021).

2.4. Experience faced by newly qualified in-service teachers in the use of Digital technology.

Several studies have indicated that teachers' attitudes toward digital technologies influence their use of technology in educational practice. To effectively change their teaching behaviour, teachers must recognize the clear benefit of using educational technologies to promote prevalent disciplines such as STEM (Science, technology, engineering and mathematics) in 4IR classes (Huynh & Nguyen, 2021). Teachers must first understand emerging technology in order to incorporate it into their classrooms. This comes after research revealed that any attempt to integrate digital technology must take into account teachers' pedagogical beliefs and practices (Yu, 2022).

A key finding from the study was that teachers expressed concerns about the effectiveness of digital technology in achieving more effective lesson delivery. Teachers acknowledged that it would require significant effort to fully grasp the effective use of digital tools (Koopman, 2022). This suggests that teachers may face challenges in adapting their teaching practices to incorporate technology effectively, which can hinder their ability to leverage the potential benefits of digital learning.

According to Koopman (2022) newly qualified teachers expressed negative feelings that correlated with several interdependent variables such as the level of pedagogical knowledge, lack of infrastructure and knowledge of how to use digital technologies as an integrative system of the curriculum. While teachers with more teaching experience had no challenges with pedagogical and content knowledge, they seemed not interested in the use of technology as a transformative means for pedagogy (Pongsakdi, Kortelainen & Veermans, 2021). On the other hand, the newly qualified in-service teachers encountered challenges with the pedagogical content knowledge, thus experiencing difficulties with integrating their technological knowledge into the pedagogical content knowledge (PCK).

2.5. Teachers Attitudes towards digital technology.

Pre-service experience with ICT in teacher training institutes may affect newly qualified teachers' relationship with ICT integration in their classrooms. Based on accumulated theoretical and empirical evidence, the overall perception of digital technology in the classroom, particularly in the townships, portray a rather negative picture (Mkhize, 2018). Shambare et al. (2022) conducted a study that examined South African rural teacher's views on the readiness of adopting digital technologies for 4IR teaching. While his finding was mostly positive, some teachers perceived educational technologies as a constraint. The reasons that were highlighted from their interviews included inadequate training and disruptions in the use of gadgets in the classroom especially with time constraints. Similarly, according to Pettersson (2021) most teachers believe in technology-enhanced instruction, but they would rather adopt the traditional chalk and talk instruction.

According to a study by Mkhize (2018), teachers' concerns about the transition to digital learning centre on the infrastructure, particularly the cost and pervasiveness of broadband connectivity. They claim that the difficulties of integrating technology into instruction is increased by the social backdrop of 4IR and the current educational system. Yet, there is still a big problem with the efficient use and integration of instructional technologies. Teachers need to acknowledge the necessity of digital media for successful integration of 4IR skills as stipulated in policies such as the National Integrated White Paper on ICT and National ICT policy (Whalley, France, Alice & Welsh, 2021).

The role of Curriculum Development and policy for pedagogical technology use in the classroom. South Africa's journey with integrating technology into classrooms reveals a complex interplay between curriculum and policy implementation. Policy frameworks like the 2010 National Curriculum Statement laid the groundwork, promoting learner-centred approaches and digital literacy skills (DoE, 2013). This opened the door for technology as a potential tool for individualized learning and bridging socio-economic gaps. However, the 2010 Education for All Strategic Plan highlighted persistent challenges: unequal access to infrastructure and technical support, coupled with concerns over teacher readiness and effective utilization of available resources (DoE, 2013).

Despite these initial hurdles, subsequent initiatives like the 2013 National e-Learning Strategy aimed to close the gap by providing essential equipment and teacher training programs (DoE,

2013). Yet, research from 2010 by Burgess et al. pointed to the critical need for policy to move beyond mere resource provision (Burgess et al., 2010). Aligning curriculum content with available technology and ensuring assessment methods embrace the diverse learning pathways enabled by technology remain crucial challenges (Draper et al., 2008).

2.6. Case studies of specific township schools

In South Africa's township schools, the echoes of children engaged in online learning mingle with the familiar buzz of classroom activity, painting a picture of a complex dance between tradition and digital innovation. Integrating technology into these historically resource constrained environments hold immense promise, fostering student engagement, promoting 21st-century skills, and bridging socio-economic gaps. Initiatives like the Department of Basic Education's National e-Learning Strategy (2020) are equipping schools with tablets and internet access, enabling access to virtual libraries, interactive resources, and online learning platforms (Mots'habi & Ramorwedi, 2022). This digital influx fosters personalized learning pathways, catering to diverse learning styles and needs (Mabaya & Moloi, 2022). Collaborative projects facilitated by online platforms empower learners to connect with peers across geographical boundaries, developing vital 21st-century skills like communication and collaboration (Warschauer & Zheng, 2015).

However, challenges remain. Unequal access to reliable internet and electricity perpetuates existing educational inequalities, leaving some schools lagging behind (Adedoyin et al., 2022). Teacher concerns regarding inadequate training, technical difficulties, and workload pressures pose further hurdles (Koehler & Mishra, 2008). Balancing traditional pedagogies with technology integration also requires careful consideration, ensuring technology augments rather than replaces effective teaching practices (Cuban, 2013).

Despite these challenges, the integration of technology in township schools offers a glimpse into a future where digital tools empower both teachers and learners. By addressing concerns, providing targeted support, and fostering a culture of innovation, this transformative journey can bridge the digital divide and ensure all learners have the opportunity to thrive in the technology-driven world of tomorrow.

2.7. Bridging the digital divide

Bridging the digital divide in educational technology is a complex challenge with far-reaching consequences. It refers to the gap between those who have access to and can effectively use technology for learning, and those who do not. This gap can be caused by a variety of factors, including lack of access to devices and internet: Many learners, particularly in rural or low-income communities, lack access to computers, tablets, or smartphones, and even more lack reliable internet connections. Without these basic tools, they are unable to participate in online learning or use educational technology effectively.

Lack of digital skills, even if learners have access to devices and internet, they may not have the skills to use them effectively for learning. This can include basic skills like typing and using the internet, as well as more advanced skills like online research and critical thinking.

Cost in educational technology can be expensive, including the cost of devices, internet access, and software. This can be a major barrier for low-income families and learners. Disability: Learners with disabilities may face additional challenges in accessing and using educational technology. This may be due to a lack of accessible software or hardware, or a lack of training and support for teachers and learners. The consequences of the digital divide in education are significant. Learners who lack access to technology are at a disadvantage in the classroom and in the job market. They may be less likely to graduate from high school or college, and they may have fewer opportunities to get good jobs.

2.8. Challenges of Tech-Savvy Teaching for NQTs:

NQTs in South Africa often face unique challenges in integrating technology into their teaching practice. These include, limited pre-service training: Initial teacher education programs may not adequately equip NQTs with the necessary digital skills and pedagogy for tech-infused classrooms (Mkwananzi et al., 2020). Inadequate access to technology and resources: Schools in underserved communities may have limited access to technology infrastructure, reliable internet connectivity, and relevant software, hindering NQTs' ability to implement tech-based strategies (Govender & Anant, 2020). Lack of confidence and technical expertise: NQTs, especially those not adept with technology, may feel overwhelmed and lack the confidence to effectively utilize technology in their teaching (Van de Venter & Louw, 2020). Pedagogical integration challenges: Successfully integrating technology into teaching requires more than

just technical skills. NQTs may struggle to align technology with specific learning objectives and design engaging tech-supported activities (Adigwe, 2020).

Despite these challenges, embracing technology within South African classrooms presents exciting opportunities for NQTs such as enhanced engagement and learning this means technology can make learning more interactive, personalized, and accessible, catering to diverse learning styles and fostering deeper understanding (Chirimba & Mafumise, 2020). The development of 21st-century skills which include integrating technology equips NQTs with the skills their learners need to thrive in a technology-driven world, such as critical thinking, collaboration, and digital literacy (Molefe & Molo, 2020). The improved access to resources and information breaks down geographical barriers, providing NQTs and their learners access to a vast array of educational resources and information (Mokhele & Ng'ambi, 2020). While Motlhabane & Moeti (2020) assert that increased professional development offer holistic opportunities, structural support is very impactful in the way that newly-service teachers respond to the technological advancement required in their integration of digital pedagogy. Therefore, to empower NQTs as tech-savvy teachers, teacher education programs must integrate robust technology training, focusing on both digital skills and pedagogical integration strategies (Mkwanzan et al., 2020). Workshops, online courses, and peer-to-peer learning sessions can equip NQTs with the confidence and expertise to utilize technology effectively in their classrooms (Van de Venter & Louw, 2020). Establishing online communities and resource repositories specific to NQTs can foster information sharing, collaboration, and problem solving (Adigwe, 2020).

2.9. Conclusion

Empowering NQTs to harness the potential of technology in South African classrooms requires a multi-pronged approach. By addressing the challenges and capitalizing on the opportunities, we can create a supportive ecosystem where NQTs can flourish as confident, tech-savvy teachers, paving the way for a future of 21st-century learning. By investing in NQTs and their technological integration skills, we are not only equipping them for success but also ensuring the future of equitable, technology-driven education for all South African learners.

Chapter Three: Theoretical Framework

3.1. Introduction

In the realm of educational research, theoretical frameworks serve as essential lenses through which researchers interpret, analyse, and understand complex phenomena. One such framework that has gained prominence in educational settings is the Activity Theory Framework. Rooted in socio-cultural theory, Activity Theory offers a comprehensive perspective on human behaviour, learning, and development within the context of social and cultural practices. This theoretical framework, originally formulated by Russian psychologist Lev Vygotsky and further developed by his followers, provides a rich conceptual toolkit for investigating the intricacies of human activities in various settings, including educational environments.

3.2. Cultural Historical Activity Theory (CHAT)

The research study will be guided by the Activity Theory theoretical Framework. The core of an activity, according to the Activity Theory, is the relationship between the subject (human doer) and object (the thing being done) forms the core of an activity. Often what people seem to be doing, what they say they are doing, and what they do, can be quite different. Engeström (1987) popularised the Activity Theory using the concept of a ‘collective activity system’, as depicted in the familiar triangle of Figure 1, with the elements: subject, object, tools, rules, division of labour and community.

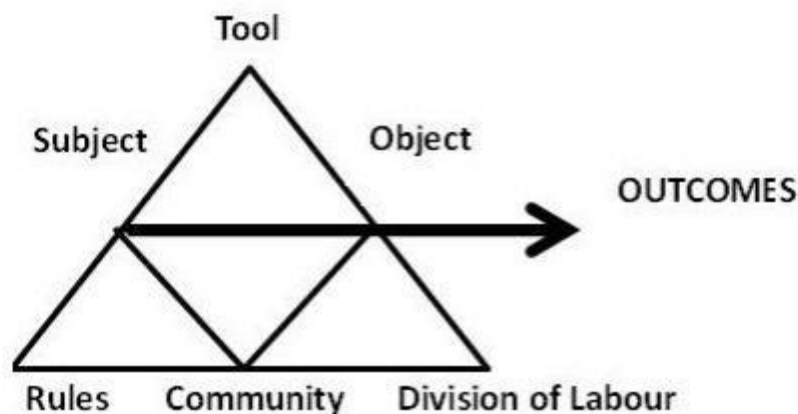


Figure 1: The Engeström (1987) representation of a collective Activity system

Activity theory holds that human beings seldom interact with the world directly. Several artefacts such as ICT, have been developed over time by humans to regulate and mediate their interactions with the world and among individuals: in simple terms to meet their needs. The use of artefacts symbolizes the hallmark of living the life of a human being (Pettersson, 2021). Artefacts can mediate the activities of human beings as referred to as artefacts. These can be simply referred to as tools or instruments. Physical artefacts are easy to recognize as their effects on the everyday life of humans cannot be overlooked (Alayyar & Zeyab, 2023), for instance the use of simple artefacts like books that we read, phones that we use, road signs on the roadway, cutlery for breakfast and so on. These artefacts are inextricably engaged with activities and communities on a daily basis.

Alayyar & Zeyab (2023) proposes three levels of artefacts and describes the way each of influence human activities. They are as follows:

1. Some artefacts are directly involved in human work to mediate the relationship between the subject and object of the activities; these are the first human tools that we use e.g., bowls, computers, telecommunication networks) and become the primary networks.
2. The second level of artefacts is the combination of both the primary artefacts and the models of actions used to preserve and transmit skills in the production and use of primary artefacts: they are referred to as secondary artefacts.
3. The third level is called the tertiary artefacts because they contain elements of the imaginative mind that provides conceivable change in the existing practices of human life. As per (Gutierrez, Jurow & Vakil, 2020) this imaginative artefact can come to colour the way we see the actual world acting as a tool for changing the current praxis.

The emphasis on the mediation of these tools in the interaction between the human minds and an objective is at the core of the activity theory. This is because the activity theory recognizes the role the human brain plays in the cultural-historical development of human life. For development to occur - that is, the change from existing practice to a new order, the activity must first be conceived in the human mind. Imaginative artefacts are put to use to redefine and develop new concepts. This can be further explained using the concept of internalization and externalisation. For every phase of development, the mind goes through reflective analysis of an existing cultural practice, which represents a process of internalization (Alayyar & Zeyab, 2023). However, this reflective, analytical, exercise alone is

not enough. The produced mental structure must be designed and implemented in the exterior for another level of development to take place, usually in the form of new practice. This is the externalisation process.

Activity theory representation for the study

This representation facilitated a comprehensive analysis of the contextualized nature of teachers' readiness for pedagogical technology use, yielding valuable insights for informing teacher training programs, educational policies, and instructional practices aimed at fostering effective technology integration in township school settings. Table 1 shows the categories and descriptions within Cultural Historical Activity Theory.

Table 1: Cultural Historical Activity Theory for the study pertaining to newly qualified teachers' integration of ICTs in education

Categories	Information	Definition
Subject	The humans from whose perspective the activity is being explored	• Teachers • Learners
Objects	The object of the activity is to teach learn and engage in class activities with digital technology	• Delivery of content knowledge • Teachers teaching subject matter knowledge. • Learners engaging actively in the class
Tools	ICT and non-ICT tools that mediate the interaction between the subjects and the objects of classroom activity	• ICT tools (learning and teaching tools, internet, computers, projectors, learning management systems) • Learning and teaching tools, classroom infrastructure, chalkboard/whiteboard marker, smartboards, desk, chairs)
Rules	Procedures and policies that mediate between the subjects and their community which includes the entire school environments the National Developments Policy of ICT and the National Framework for professional teachers.	• School disciplinary rules • Rules guiding the school procedures. • Learning models followed by the school. • Expected student etiquette and behaviour. • Implicit and explicit beliefs of learning and performances • Provision of ICT resources required to teach in various subjects. • ICT Tools and systems form simulation and modelling. • ICT Policies guiding the use of ICT in the schools. • Staff training policies • Costs and Budget • School curriculum

Community	The socio-cultural and context of the activity system in township schools	• The school management team and teachers. • The Department of Basic Education • ICT Coordinators • Districts • Other school • Parents • Learners • Society at large
Division of labour	Roles and activities assigned to work inter-connectedly together to achieve the object of the activity.	• Teachers prepare learning materials, coordinate learning in the classroom and assess learners' performances. • Learners are expected to participate in the learning process and behave according as per curriculum expectations. • Administrators and General school workers are to work collectively in their various functioning capacities.

Source: (Kuutti, 1996)

Chapter Four: Research Methodology

4.1 Introduction

Research is an intellectual endeavour. It oversees bringing fresh information to light. It is also in charge of correcting current errors, eradicating existing misunderstandings, and adding new information to the existing pool of knowledge. Research methodology is the way by which researchers need to do their study. Drawing from Sileyew's insights (2019), the research process is characterized by a meticulous construction of research questions and objectives, which guide the study's direction and outcomes. Researchers systematically collect, analyse, and interpret data gathered throughout the study period to address these questions and objectives. Two primary research approaches, quantitative research, and qualitative research, offer distinct methodologies for investigating phenomena. Quantitative research employs numerical data and statistical analysis to quantify relationships and patterns, providing structured and measurable insights into phenomena. On the other hand, qualitative research involves the collection of non-numerical data such as interviews, observations, or textual analysis to explore underlying meanings, motivations, and experiences, offering rich, in-depth understandings of complex phenomena. Researchers select the most appropriate approach based on the nature of their research questions, objectives, and the depth of understanding required. Together, these

research approaches form the foundation for rigorous inquiry and contribute to advancing knowledge in various fields.

The study was guided by the following research questions.

1. How do newly qualified in-service teachers integrate digital technology in their subject content that the 4IR space prefers?
2. How well-prepared are newly qualified in-service teachers to use pedagogical technology in the classroom?
3. What challenges do newly qualified in-service encounter in accelerating the use of digital technology in their classroom?
4. What strategies could newly qualified in-service teachers use to accelerate the integration of digital technology in the classroom?

4.2. Research Methodology

According to Kothari (2004), quantitative research is fundamentally about gathering numerical data to describe a certain phenomenon; specific topics appear to be naturally suited to being answered using quantitative approaches. A quantitative study is one that uses and analyses numerical data using statistical methodologies. They ask who, what, when, where, how much, how many, and how. Quantitative research methods are intended to generate statistically valid data that indicates the number of people who do or believe something. For example, when doing a large-scale needs assessment or baseline survey, quantitative research is extremely valuable (Kothari, 2017). It is unrelated to the researcher, and the results should be comparable regardless of who does the research.

The qualitative research approach is concerned with the subjective evaluation of attitudes, views, and behaviour. Qualitative researchers are interested in understanding how individuals construct meaning, or how they make sense of their environment and the experiences they have in it. In such a case, research is a function of the researcher's insights and perceptions. Such a study technique produces outcomes that are either non-quantitative or have not been submitted

to rigorous quantitative examination Qualitative research is a situated activity in which the observer is in the world. It is a collection of interpretative and material acts that make the world visible. They transform the world into a succession of representations, such as field notes, interviews, dialogues, images, recordings, and self-memos. Qualitative research at this level entails an interpretative, naturalistic approach to the world. This implies that qualitative researchers observe events in their natural environments, aiming to make sense of or interpret them in terms of the meaning's individuals assign to them (Mishra & Alok, 2022). The study proposed to use a qualitative method as data were gathered from six teachers from selected township secondary schools. The information gathered was analyzed qualitatively from the participants' transcripts, which were eventually transcribed. The criteria for sampling was mainly based on predominately newly qualified teachers who are between the ages 25+ and born digital natives.

4.3. Research Paradigm

This research paradigm is often employed in educational research due to its numerous advantages. Consequently, in mixed methods research, researchers employ both forms of data since the combination provides the best knowledge of a study topic. Several academics have characterized it in different ways. According to Janice Morse (2003), research paradigm is a strategy for doing scientifically rigorous research that includes a qualitative or quantitative core component that leads the theoretical drive, as well as qualitative or quantitative supplemental components. These study components work together to improve description and comprehension and can be carried out concurrently or sequentially. Guba and Lincoln (2005) sum it up nicely that it is conceivable to combine aspects of one paradigm with those of another to conduct research that represents the best of both worldviews. This is especially true if the models (paradigms) have axiomatic aspects that are comparable or strongly resonate with one another. The study embraced the interpretivism paradigm as it was deemed suitable for establishing a clear link between the research and the research subject. This paradigm acknowledges the inherent connection between humans and their knowledge, recognizing that individuals cannot be separated from their socio-cultural contexts, experiences, and interpretations. By adopting an interpretivist approach, the study aimed to delve deeply into the perspectives, experiences, and meanings attributed by teachers to their readiness for pedagogical technology use in township schools. This paradigm facilitated a nuanced understanding of how teachers' beliefs, motivations, and socio-cultural backgrounds influence their technology integration practices. Moreover, interpretivism allowed for the exploration of

the complex interplay between teachers' subjective realities and the broader educational landscape, shedding light on the contextualized nature of technology integration in township school settings. Through this lens, the study sought to uncover rich insights into the intricate dynamics shaping teachers' readiness for pedagogical technology use, ultimately contributing to more effective teacher training programs, educational policies, and instructional practices tailored to the needs of township schools.

Interpretivism paradigm

Through the interpretivist lens, investigating the preparedness of newly qualified in-service teachers for integrating pedagogical technology in the classroom involved exploring their subjective experiences, beliefs, and interpretations (Creswell & Creswell, 2022). This perspective acknowledged the significance of their individual backgrounds, teaching philosophies, and technological skills (Akyol & Ozturk, 2022) in shaping their approach to technology adoption. Rather than assessing readiness through a standardized measure, interpretivism emphasized understanding teachers' personal narratives, examining their self-efficacy beliefs, attitudes towards educational technology, and motivations for incorporating it (Kizildag & Ozcelik, 2022). Qualitative research methods such as interviews and classroom observations (Merriam & Tisdell, 2022) yielded rich data that unveiled the nuanced meanings and emotions associated with their use of technology.

This paradigm highlighted the influence of pre-service training on teachers' preparedness, questioning whether it adequately equipped them for the dynamic digital landscape (Yildirim & Ozcelik, 2022). It also examined the school environment, leadership support, and access to resources as pivotal factors shaping their capacity and willingness to integrate technology meaningfully (Cokadar & Akcayir, 2022). Prioritizing understanding over quantification, interpretivism provided valuable insights into the real-life experiences of newly qualified teachers. This deeper understanding of their lived experiences could guide tailored professional development initiatives aimed at addressing their specific needs and concerns, ultimately nurturing their confidence and proficiency in using technology to enhance learning experiences for their learners.

4.4. Research Design

The trustworthiness of the results obtained was greatly influenced by the research design. A well-crafted research design acts as the blueprint for any successful research project. It outlines the methods and steps involved in data collection and analysis, ensuring a focused and efficient approach. Imagine a sculptor meticulously chipping away at a block of marble, their vision guiding each deliberate stroke. A well-crafted research design fulfils a similar role, according to (Braun & Clarke, 2019). It serves as the blueprint, meticulously outlining the methods and steps involved in data collection and analysis.

The benefits of a strong research design resonate throughout the entire research process. As Braun & Clarke (2019) highlights, it fosters cost-effectiveness by planning data collection and analysis upfront. This eliminates wasted time, resources, and energy, much like a sculptor avoids unnecessary chipping away at irrelevant areas of the marble. Furthermore, a well-designed study, as Smith & Osborn (2019) suggests, facilitates the smooth execution of various scientific procedures, maximizing the amount of valuable information obtained while minimizing effort and cost. Just as a sculptor carefully chooses their tools based on the desired outcome, the research design ensures the selection of data collection and analysis techniques specifically tailored to address the research question, avoiding the collection of irrelevant or unusable data, as Smith & Osborn (2019) warns against.

The significance of a research design extends beyond its immediate benefits. Just as a blueprint provides a clear vision for the final structure, the research design offers a roadmap for the entire study (Creswell & Poth, 2021). It guides researchers in selecting the most appropriate methods for data collection and analysis, ensuring a smooth and efficient research process. This transparency allows for collaboration with other specialists in relevant fields. By clearly outlining the research plan, the project becomes open to valuable insights and expertise from external sources, ultimately strengthening the research endeavour. In essence, a well-designed research plan acts as the cornerstone of a successful and efficient research project. It promotes cost-effectiveness, maximizes information gain, targets relevant data collection, and provides a clear roadmap for the entire study. Moreover, this transparency fosters collaboration, leading to a more robust and impactful research journey. Consequently, it offered a strong foundation for the whole research. By creating an advanced strategy for the entire research study, it was feasible to maximize knowledge while using the least number of resources such as time, money, and effort possible. The research design was meant to give a suitable structure for a study

(Sileyew, 2019). The choice of research technique was a critical decision in the research design process because it defined how relevant information for a study would be gathered; yet the research design process comprised several connected considerations. Consequently, it offered a strong foundation for the whole research. By creating an advanced strategy for the entire research study, it was feasible to maximize knowledge while using the least number of resources such as time, money, and effort possible. The research design was meant to give a suitable structure for a study (Sileyew, 2019). The choice of research technique was a critical decision in the research design process because it defined how relevant information for a study would be gathered; yet the research design process comprised several connected considerations. Research design was required because it ensured the seamless execution of multiple research processes. It was similar to a blueprint that was required in advance to plan the methods to be utilized for gathering relevant data and the techniques to be employed in its analysis for the preparation of a research project. Just as a blueprint and a map were required for a cheaper and more appealing house building, we required a blueprint or design for the smooth functioning of research (Pandey & Pandey, 2021). The study used case studies of three schools in Soweto in Gauteng. Case studies were frequently employed for inductive investigation of previously unknown phenomena, i.e., theory formation (Stake, 2008). Nevertheless, deductive theory testing by analytical generalization has also been advocated, most notably by Yin (2013). Ketokivi and Choi (2014) proposed another type of case study, arguing that theory development was also an acceptable objective for case studies. The study took place in a selected few secondary school in the township areas.

4.5. Data collection instrument

Understanding newly qualified in-service teachers' readiness for pedagogical technology required delving beyond standardized metrics and into the heart of their lived experiences. Qualitative data collection methods offered a powerful lens to explore their attitudes, perceptions, and beliefs surrounding technology integration in the classroom (Creswell & Poth, 2018).

This study employed a qualitative research design to gain a deep understanding of teachers' experiences and perspectives on technology integration in education. In-depth interviews served as the primary data collection method, providing a platform for individual voices to be

heard (Bogdan & Biklen, 2018). This aligns with the core principle of qualitative research, which prioritizes capturing the richness of participants' narratives and lived experiences. Semi structured interviews, as advocated by Ertmer and Koehler (2012), were utilized to facilitate a comprehensive exploration of teachers' technology use. By following a pre-determined set of guiding questions, the interviews explored the contextual factors influencing pedagogical technologies practices, as identified by Sandholtz et al. (2017). Furthermore, the interview structure incorporated prompts to gauge teachers' comfort level and perceived self-efficacy with different technologies (Ertmer & Koehler, 2012). This aligns with Bandura's (1997) concept of self-efficacy, a crucial factor in successful technology integration.

The research further employed open-ended probes to delve deeper into the multifaceted nature of teachers' technology use (Miles & Huberman, 1994). These probes encouraged participants to share their motivations, anxieties, and hopes associated with integrating technology. This qualitative technique facilitated a more nuanced understanding of the underlying beliefs, attitudes, and emotions shaping teachers' perceptions (Ertmer et al., 2012). Additionally, open ended probes explored teachers' aspirations and concerns regarding the potential of technology to enhance student learning and foster innovative teaching practices.

Much qualitative research involves the collection of data through participant interviews (Creswell, 2013). The study used interviews as a method of data collection, as it is the most direct and easiest method of acquiring thorough and rich data on the phenomenon being investigated. Although face-to-face interviews were traditionally the most common, virtual platform interviews were utilized to overcome geographical constraints of participants. Data was gathered from secondary teachers in township schools. Six (6) teachers were sampled through use of purposive sampling. Purposive sampling, also known as judgmental sampling, is a non-probability sampling technique where participants are intentionally selected based on specific characteristics relevant to the research question (Patton, 2015). Unlike random sampling, it does not aim to represent the entire population but rather focuses on groups or individuals who can provide rich information and insights into the phenomenon under study. The aim was to increase the depth (as opposed to breadth) of understanding the phenomenon.

4.6. Data analysis

Data analysis involves the process of extracting insights and identifying behavioural patterns from data. According to Mertens (2014), ongoing data analysis during data collection allows

researchers to continuously uncover new insights, which may prompt adjustments to the data collection process or an extension of data collection until the final dataset is ready for analysis. Additionally, data analysis entails the application of statistical methods to identify phenomena and formulate hypotheses based on the data, as defined by Bogdan and Biklen (2007). Qualitative data analysis, on the other hand, involves manipulating, organizing, and segmenting data to identify patterns, concepts, and meanings, as described by the same authors. In the study, data analysis was considered as dataset as a whole and then breaking it down into manageable segments for a more meaningful reconstruction. Classification and categorization were utilized to facilitate comparisons and contrasts between different data patterns, ultimately leading to a more informed decision or conclusion. Moreover, themes and concepts from relevant literature were integrated into the data analysis process, as noted by Cohen et al. (2007).

Various types of analysis were considered for the study, including content analysis, narrative analysis, discourse analysis, and thematic analysis (Cohen et al., 2007; Punch, 2009; Braun & Clarke, 2006). Content analysis involves systematically analysing textual, visual, or audio content to identify themes, patterns, or trends. It's often used to explore the frequency and distribution of certain topics or concepts within a dataset. Content analysis is valuable for research as it allows researchers to quantitatively examine large volumes of data, providing insights into societal trends, public opinion, and media representations (Neuendorf, 2017). Narrative analysis focuses on examining the structure, content, and meaning of narratives or stories shared by participants. Researchers analyse the narratives to understand individuals' experiences, perspectives, and interpretations of events. Narrative analysis enriches research by providing detailed insights into subjective experiences, cultural meanings, and personal identities (Riessman, 2008). Discourse analysis investigates the use of language in communication to uncover underlying social, cultural, and power dynamics. It examines how language constructs meaning, shapes identities, and influences social interactions within specific contexts. Discourse analysis enhances research by revealing hidden ideologies, social structures, and power relations embedded within language use (Gee, 2014). Thematic analysis involves identifying, analysing, and interpreting recurring themes or patterns within qualitative data. Researchers categorize and code data according to common themes, allowing for a deeper exploration of participants' experiences, perspectives, and attitudes. Thematic analysis is valuable for generating rich and nuanced insights into complex phenomena, facilitating a comprehensive understanding of research topics (Braun & Clarke, 2006). These methods offer

diverse approaches for collecting and analysing qualitative data, each contributing unique benefits to research endeavours. By employing these methods, researchers can gain valuable insights into human behaviour, societal dynamics, and cultural phenomena, enriching the depth and scope of research findings.

Thematic analysis was selected due to its emphasis on identifying themes and patterns relevant to qualitative analytical methods within specific epistemological and ontological frameworks (Braun & Clarke, 2006). Additionally, thematic analysis was acknowledged for its flexibility, utility, and compatibility with diverse research contexts (Braun & Clarke, 2006). This approach provided detailed yet intricate data, contributing to a comprehensive understanding of the subject matter (Braun & Clarke, 2006).

4.7. Ethical Considerations

Human subject protection requires the use of suitable ethical norms in each scientific endeavour. Due to the in-depth nature of the research process, ethical questions have a special resonance in qualitative studies. Research involving potentially vulnerable populations, such as educators, necessitates heightened sensitivity to ethical considerations. During face-to-face interviews, participants may disclose sensitive experiences or emotions that could cause them distress. To prioritize participant well-being, the study adhered to ethical principles including informed consent wherein participants received a detailed informed consent form outlining the research purpose, data collection methods, potential risks, and their right to withdraw at any point (Appendix C & D). In this study, obtaining a DBE (Department of Basic Education) clearance (Appendix B) was a crucial step to gain access to schools and conduct interviews with teachers. However, it is important to acknowledge that DBE clearance is primarily an administrative requirement for research access and does not substitute for a thorough informed consent process and adherence to broader ethical principles when working with human subjects. The researcher obtained ethical approval through the university ethics committee, demonstrating commitment to following established research guidelines (Appendix A), ensuring adherence to any regulatory requirements for conducting research within schools. This two-pronged approach strengthens the ethical foundation of the study and fosters trust with participants and relevant authorities.

The anonymity and confidentiality of the participants was preserved by not disclosing their names and identities in the data collection, analysis and reporting of the study findings. Privacy

and confidentiality of the interview setting was managed carefully during an interview session, data analysis and dissemination of the findings.

4.8. Conclusion

In conclusion, this study adopted a multi-pronged approach to data collection, combining in-depth interviews, semi-structured questions, and open-ended probes. This holistic approach provided a rich tapestry of teachers' experiences and perspectives on technology integration. By drawing upon insights from these methodologies, researchers aimed to uncover the complex interplay of factors influencing teachers' technology use and identify opportunities to support their professional development in effectively integrating technology within their classrooms (Ertmer et al., 2012; Mishra & Koehler, 2006). By implementing comprehensive ethical considerations, the study aimed to create a safe and secure environment for participant voices to be heard while safeguarding their privacy and well-being.

Chapter Five: Data Presentation, Analysis and Discussion of Findings

5.1. Introduction

This chapter serves as a critical juncture where the collected data undergoes comprehensive scrutiny and interpretation. The researcher navigated through the rich tapestry of qualitative data, employing various analytical techniques to uncover patterns, themes, and insights embedded within. The presentation of findings involved a meticulous exploration of the dataset, followed by a systematic analysis aimed at extracting meaningful interpretations. Through the lens of qualitative inquiry, the chapter delved at deeper nuances of participants' experiences, perspectives, and narratives, offering a holistic understanding of the research phenomenon.

Furthermore, the discussion of findings provides a platform for synthesizing the discovered patterns with existing literature, facilitating a dialogue between empirical evidence and theoretical frameworks. Ultimately, the chapter illuminated the unique insights gathered from the qualitative data, paving the way for a nuanced understanding of the research topic and contributing to the advancement of knowledge.

Table 1 below gives the composition of the participants interviewed within their working setup. The names of the participants were coded as DS#1 to represent the school's name followed by the first participant interviewed (e.g., DS is the school's name, #1 is the name of the first participant interviewed).

School name	Participant Name	Gender
DS	#1	Female
DS	#2	Male
JS	#3	Female
JS	#4	Female
CS	#5	Male
CS	#6	Male

Table: 1

5.2. Data Analysis approach

The qualitative data analysis provides an overview of fundamental aspects and outlines the various types of qualitative data. Subsequently, this chapter explores distinct approaches to qualitative data analysis: theoretical propositions and content analysis. Qualitative data analysis involves a systematic process of describing, classifying, and establishing connections among phenomena within the researcher's conceptual framework. Initially, it is crucial to accurately describe the phenomena under investigation. This is followed by the development of a conceptual framework to aid in interpreting and explaining the data, enabling the classification of the data. Subsequently, concepts are constructed and interconnected to elucidate relationships and patterns within the data. Qualitative data analysis has the following general aims (Flick 2013, p. 4):

“Describe 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.”

Thematic analysis, as outlined by Braun and Clarke (2006), is a qualitative data analysis approach that involves scouring a dataset to detect, examine, and document recurring patterns. It serves to both depict and interpret data, particularly through the identification of codes and the development of themes. A notable characteristic of thematic analysis is its adaptability, allowing it to be utilized across various theoretical and epistemological perspectives, and to be implemented in diverse research inquiries, methodologies, and sample sizes.

Data presentation was driven by the following research questions:

1. How do newly qualified in-service teachers integrate digital technology in their subject content that the 4IR space prefers?
2. How well-prepared are newly qualified in-service teachers to use pedagogical technology in the classroom?
3. What strategies could newly qualified in-service teachers use to accelerate the integration of digital technology in the classroom?

The following categories were noted during data presentation.

Pedagogical approach in the classroom, teachers' readiness in teaching digital technology, teacher profession development, communities of practice

1. Pedagogical approach in the classroom

In the contemporary classroom, the pedagogical approach has evolved significantly with the integration of digital technologies. This shift represents a fundamental transformation in how teachers conceptualize teaching and learning. Pedagogical practices now incorporate a diverse array of digital tools and resources, such as interactive whiteboards, educational apps, online collaboration platforms, and multimedia content. These technologies facilitate dynamic and interactive learning experiences, engaging learners in ways that traditional methods often cannot. Moreover, the integration of digital technologies enables personalized learning pathways, catering to the diverse needs and learning styles of individual learners. However, effective integration requires more than just the presence of digital tools; it demands thoughtful planning, pedagogical creativity, and ongoing professional development to ensure that technology enhances rather than detracts from the learning process. When wielded effectively, digital technologies can

empower teachers to create immersive and innovative learning environments that foster critical thinking, collaboration, and digital literacy skills essential for success in the 21st century. However, despite the good promises that digital technologies offer in the classroom, teachers interviewed express mixed feeling about inclusion of technology in their teaching practice. JS#3 and CS#6 mentioned that their teaching practices is still cantered on traditional methods of teaching.

We have interactive whiteboards in selected classrooms, but we do not use such tools. Thus, our teaching is still dominated by chalk and talk scenario.
[JS#3]

So far, the department has not installed any digital tools that supplement teaching learning. Our classrooms are still having traditional chalkboard, and thus we are teaching using the chalkboard, and the use of the textbooks.
[CS#6]

The two participants indicate that their teaching approach is still reliant on traditional chalkboard and textbook-based teaching methods. This shared sentiment from both JS#3 and CS#6 indicate a departmental-level issue in providing resources and fostering an environment conducive to embracing digital tools for enhanced learning experiences.

On a different note, DS#2 and JS#4 commented about the use of multimedia in the classroom:

While we wait, for the department, I try to keep a blended learning approach, given that I teach Creative Arts, I use media in the classroom such as videos to demonstrate to learners in the classroom [DS#2]

Because this is my first teaching job, I try to implement e-learning strategies in my classroom, I use chalk and talk for my lessons and give learners homework which involves the use of information searching tool, YouTube videos and recording and use that as reflection and remedial work in class, we flip from chalk and board to e-learning [JS#4]

The participants showcase a commitment to embracing digital technologies in education, albeit through slightly different approaches whereby JS#4 prioritizes a blended learning approach with a focus on multimedia, while DS#2 demonstrates an openness to experimenting with various e-learning strategies, indicating a willingness to adapt to evolving educational practices. These insights highlight the diverse ways

in which teachers can integrate digital technologies to enhance teaching and learning experiences in the classroom.

JS#3 expressed that:

Teaching technology requires a lot of concrete knowledge which is often lacking in textbooks and everyday discussions, I often ask for extra lessons on Wednesday to project videos for learners on concepts learnt, this makes learning move from abstract to practical everyday knowledge, what I love about our Wednesday classes is that we incorporate an online class in Teams with my neighbouring schools to collaborate and share insightful information to prepare for competitions and Olympiads the school normally engages with... [JS#3]

Contrary DS#1 who teaches technology at the same district wherein pedagogical technology solutions are apparent, shared that:

Despite my adequate knowledge of technology, applying pedagogically in my class will be time consuming and tedious because of the mismatch, whenever learners see the smartboard at work, they see a toy and whenever we log in to DBE Bongani Education LTSM Solutions (the provision and management of learning and teaching support material online/ cyber-school support) learners make jokes about the speaker delivering content and because of the size of learners, learners are unable to view well or listen well to videos. [DS#1]

In township schools, integrating technology into the curriculum, especially in subjects like technology, presents significant challenges. One major obstacle is often seen as an add-on rather than an integral part of the learning process. This results in a lack of motivation among teaching experiences encountered by DS#1 is the lack of coherence in subject content matters.

Furthermore, a study by Johnson (2023) found that many teachers struggle with the ambiguity surrounding the integration of technology into existing curriculum structures. Moreover, the fast-paced nature of technological advancements exacerbates the problem. Research by Lee and Park (2023) underscores the need for ongoing professional development to keep up with new tools and methodologies. However, the current professional development opportunities provided to teachers often fall short, failing to address the specific needs and challenges faced in township schools. The successful integration of technological tools in township classrooms by newly qualified teachers within the framework of the Fourth Industrial or education should

provide empowerment, and societal development in communities like Soweto. Revolution curriculum holds transformative potential by embracing access and equity, cultivating digital literacy and 21st-century skills, fostering pedagogical innovation and learner-centred learning, engaging with the community, and promoting evaluation and continuous improvement, teachers located in township schools can harness the power of technology to create inclusive, dynamic, and impactful learning environments for all learners. The integration of technological tools in township classrooms has the potential to democratize access to quality education and empower historically marginalized communities. By providing learners in Soweto with access to digital resources, interactive learning platforms, and global knowledge networks, newly qualified teachers can bridge the digital divide and foster inclusive educational environments.

II. Teachers' readiness in teaching digital technology

Teachers' readiness in teaching digital technology is a multifaceted issue that encompasses technical proficiency, pedagogical understanding, and adaptability. While many teachers recognize the importance of integrating technology into their teaching practices, not all feel adequately prepared to do so. Challenges may arise due to varying levels of technological expertise among teachers, limited access to training and professional development opportunities, and concerns about balancing traditional teaching methods with digital approaches. Addressing these challenges requires comprehensive support systems that provide ongoing training, resources, and encouragement for teachers to enhance their digital literacy and incorporate technology seamlessly into their teaching practices.

Newly qualified in-service teachers of Soweto township are expected to utilize various pedagogical technologies to enhance classroom teaching and learning experiences. To gauge the actual practice and implementation of these technologies, the following question was asked to the participating research participants: How well prepared are newly qualified in-service teachers to use pedagogical technology in the classroom. These practices are indicative of a modern approach to education, integrating digital tools to engage learners effectively.

I wouldn't say I am well prepared according to the standards set for us, but I do allow learners to view notes and content through the USBs I've distributed

to them at home and test them using online tools such as completing a test using google forms and then I print out the responses and scores, this helps with work overload, contact time is limited so using this technology tool helps me to navigate through my workload [CS#5]

The classroom practice by CS#5 indicates that the teacher adopts a flipped classroom approach, where instructional content is delivered online, allowing learners to learn at their own pace outside of class. This practice reflects the effective integration of pedagogical technology in the classroom, enhancing teaching and learning experiences and preparing learners for the digital demands of the 21st century, maximizing student engagement and interaction (Nguyen et al., 2023). CS#5 also employs digital assessment tools, such as an online quiz and formative assessment, to gauge student understanding and track progress. These tools provide real-time data on student performance, allowing for timely intervention and personalized instruction (Garcia & Martinez, 2023).

While the benefit of using online platforms makes learning seamless, I'm often questioned by my facilitator how accurate of the scores from online quizzes, I wish that colleagues would adopt this pedagogical technology and make it universal because while I may be prepared to use it in my lesson plan, other colleagues are dragging behind so I become less motivated to go an extra mile and extend my knowledge on other ways of delivering instruction instead of chalk-board and talk

Firstly, the concern raised by the facilitator about the accuracy of scores from online quizzes is valid. It is essential for assessments to be reliable and valid measures of student learning. Therefore, it is crucial to ensure that online platforms used for quizzes have robust anti-cheating measures and provide accurate assessments that truly reflect student understanding. Secondly, it is suggested that the adoption of pedagogical technologies should be universal among colleagues. However, successful integration of technology requires careful consideration of various factors. Research indicates that teacher beliefs, attitudes towards new media, access to technological infrastructure, and administrative support are significant variables affecting technological uptake in education (Amaniampong & Hartmann, 2023). Moreover, professional development activities emphasizing the specific impact of technology on student learning can aid in its proper utilization (Ottenbreit-Leftwich et al., 2010). CS#5 points out a lack of motivation to extend knowledge and adopt innovative

teaching methods due to colleagues not keeping pace. However, it's important to recognize that teachers' adoption rates of new technology can vary based on their personal innovativeness, prior experience, and level of education they are teaching (Deng & Yu, 2023) (Amaniampong & Hartmann, 2023). Teachers in higher education might need to adopt different strategies, such as enhancing undergraduate learners' joy of learning to help them stay focused (Deng & Yu, 2023). Therefore, expecting a uniform pace of adoption across all colleagues may be unrealistic. While the speaker's push for broader adoption of educational technology is commendable.

While CS#5 gives two varying views to the readiness and preparedness of teachers for pedagogical technology, it is apparent that the preparedness is almost there, CS#6 from a different school presents an opposing view slightly suggesting that what may be an adoption of pedagogical technology in a classroom for most, in her experience it is simply a grain of sand in the Desert.

I studied mathematics and science in university, I was only taught how to cascade content knowledge to learners, as a newly qualified teacher I am not equipped enough with blended learning approaches which use technology for learning, in fact I am happy that I am teaching at a school that still has a blackboard because with Mathematics it is easy to write and erase questions and answers for learners on the board since my subject constantly requires practice work [CS#6]

CS#6 expresses that their education in mathematics and science was predominantly focused on traditional content delivery methods rather than incorporating blended learning techniques that make use of educational technology. As a teacher who has recently qualified, they feel underprepared to engage with the technological approaches encouraged by the Fourth Industrial Revolution in education. Despite this, the participant views the presence of a blackboard in their classroom positively, as it suits the iterative nature of mathematics instruction, which involves frequently writing, demonstrating, and correcting exercises and problems as part of regular practice for the learners. The participant, being newly qualified as a teacher, admits to not having sufficient training in the blended learning techniques that are supported by research advocating for their use. They also indicate contentment with teaching in an

environment that still relies on a traditional blackboard, emphasizing its practicality for the dynamic and practice-intensive nature of mathematics. This perspective may challenge the push towards adopting technological educational tools as proposed by studies on the subject.

III. Teacher profession development

In-service teachers who have only recently completed their qualifications often face significant hurdles when it comes to acquiring and being able to use digital technologies in education. A prominent issue is the lack of training which hinders the application of these technologies in an effective manner in their classrooms. Generally, teachers with less experience demonstrate a more enthusiastic approach toward digital technologies, a higher self-assurance in their capacity to utilize these tools and outdo their more seasoned colleagues in the integration of Information and Communication Technology. Conversely, those teachers with an extensive background in teaching may exhibit less inclination towards cultivating new pedagogical methods or engaging with new educational technologies. This lack of motivation can result in a suboptimal incorporation of ICT in education. Therefore, it is essential that newly qualified in-service teachers are given ample training and support to conquer these challenges and adeptly integrate digital technology into their teaching.

The most critical barrier identified is the absence of necessary training for teachers, which undermines their capability to weave technology into their educational practices. Offering comprehensive education and support to such teachers is imperative to ameliorate their novice status regarding these digital tools. The research emphasizes the necessity for teachers to both identify and harness the appropriate digital tools and platforms, often necessitating ongoing professional development.

Firstly, I think limited access to resources can be a significant hurdle. Not every school has the budget for the latest equipment, and even if the technology is available, we often find a gap in the availability of proper training to use it effectively.

Secondly, there's the aspect of institution support. Sometimes, there's a lack of administrative encouragement, or the school culture is resistant to change, which can really slow down the process of integrating digital tools.

And lastly, there's also the personal challenge of time management. Trying to learn new technologies, while you're also designing lesson plans and

managing a class, can be overwhelming. It's a lot to handle, especially when you're still finding your footing as a newcomer. [JS#4]

The issue highlighted by JS#4 hereon is a well-known barrier in educational settings. The unequal distribution of funding and resources can lead to disparities in educational technology adoption, creating a digital divide that can disadvantage both teachers and learners (Lorenz et al., 2015). It is indicated by the participant that the challenge of time management highlights the lack of structured and sustained professional development opportunities that allow teachers to explore, learn, and apply new technologies without being overwhelmed. Continuous professional development seems to become part of the school's culture, where teachers are given space and resources to innovate. This professional growth is essential in preparing teachers to navigate and effectively use technology to enhance learning outcomes (Supaat & Ihsan, 2023).

For starters, teacher training programs should have updated technology that's being used in schools, and more importantly, training should be hands-on. We should be creating lesson plans and teaching mini lessons using these tools. Also, more collaboration with local schools to understand their technology environment would go a long way [JS#3]

It was quite a shock. When I began teaching, I quickly realized that knowing about technology and using it effectively are two very different things. I felt unprepared, and there was this immediate pressure to use the school's learning management system and other tools, which I hadn't been trained on specifically. [JS#4]

I had to be proactive. Thankfully, a colleague took me under their wing and showed me the ropes, but not everyone is so lucky. There was some district-offered professional development, but it was very one-size-fits-all and didn't address the specific needs I had or the unique context of my learners. [CS#6]

The participants highlight a gap between teacher training and the realities of using technology in classrooms. JS#3 emphasizes the need for training programs to equip future teachers with the latest tools and hands-on experience creating lessons with them. Collaboration with schools would ensure this technology reflects what teachers will encounter. CS#6 reinforces this point with their experience of feeling unprepared

due to a disconnect between theoretical knowledge and practical application. They had to rely on colleagues and generic professional development that didn't address their specific needs or student context. Overall, the participants call for a more practical and targeted approach to equipping teachers with the technological skills they need to be successful in today's classrooms.

IV. Communities of Practice

The rapid advancements of the Fourth Industrial Revolution (4IR) are reshaping everything from our daily lives to workplaces and businesses. This wave of technological disruption is impacting education as well, challenging traditional teaching methods and opening doors for innovative pedagogies suited for the new generation of learners. In township schools, the potential of 4IR technologies to enhance learning is a topic of growing interest. Teachers see particular promise in digital tools used within communities of practice, where teachers can collaboratively explore and share best practices for integrating technology into their classrooms. Communities of practice (CoPs) are groups of teachers who share a passion for integrating technology into teaching. These communities provide a space for in-service teachers to learn from each other's experiences. Through collaboration, teachers can share successful strategies for using digital tools, troubleshoot challenges, and discover new resources. This ongoing exchange of knowledge and support can accelerate the integration of technology in classrooms by fostering a culture of innovation and problem-solving among teachers. This was expressed by [DS#4] who commented,

Imagine a dedicated group of teachers exploring how technology can revolutionize teaching and learning. This collaborative effort could unlock the potential of these tools to create a more engaging and effective classroom experience. Technology is ubiquitous; from traffic cameras that enforce speed limits to countless other applications, it permeates our world. Why should education be any different? We, as teachers, have a responsibility to harness this power and transform our classrooms

The participant believes collaborative effort is key to unlocking the potential of technology in education. He envisions an "interest group" where teachers can share ideas and learn from each other's experiences with technology in the classroom. This exchange of knowledge is seen as crucial for developing effective and professional

uses of these tools to improve student learning. A similar sentiment was expressed by JS#3 who said the department of education should create a space where teachers have communities of practice where they can enhance their skills, particularly harnessing technology in the classroom.

The contemporary educational landscape necessitates the establishment of Communities of Practice (CoPs) for teachers. These CoPs would provide a platform for teachers to engage in collaborative discourse on the integration of technology in teaching and learning. Such a forum would be particularly beneficial given the current deficit in many teachers' technological skillsets. By fostering a space for professional exchange and mutual learning, teachers can develop pedagogical practices that leverage technology effectively within the classroom environment, moving beyond individual exploration to a collaborative approach.

The participant argues for the importance of collaborative learning among teachers to effectively integrate technology into classrooms. The participant highlights the need for Communities of Practice (CoPs) where teachers can share knowledge and experiences. These CoPs are crucial in the current educational landscape where many teachers lack the necessary technological skills. CoPs emphasize the need for a platform where teachers can engage in collaborative discussions to overcome the deficit in technological skills among teachers. By fostering a space for professional exchange and mutual learning, teachers can collectively develop pedagogical practices that leverage technology effectively within the classroom. This collaborative approach is seen as superior to individual exploration, as it allows teachers to build upon each other's expertise and address skill gaps more efficiently. Ultimately, the participant underscores the significance of CoPs in facilitating the advancement of educational practices through the effective integration of technology. The CoPs provide a structured platform where teachers can engage in collaborative discourse with more experienced teachers, sharing best practices, resources, and innovative strategies for incorporating technology effectively into their teaching methodologies. Through CoPs, newly qualified teachers have access to a wealth of knowledge and expertise that can help bridge the gap between their initial training and the demands of the rapidly evolving 4IR space. Additionally, CoPs foster a supportive environment where new teachers can seek guidance, ask questions, and receive feedback, ultimately accelerating their professional development and enhancing their confidence in using

technology as a tool for enhancing teaching and learning experiences. By leveraging the collective wisdom of the community, newly qualified teachers can navigate the complexities of integrating technology into their classrooms more effectively, ultimately preparing learners for success in the digital age. CS#2 mentioned that he was not trained on how to integrate technology in subject specific during teacher training.

During my teacher training at university, there was a lack of instruction on utilizing technology for teaching specific topics. As a result, my use of technology in teaching is currently limited and requires improvement. One potential solution to this issue is to establish learning communities where teachers can collaborate and share their knowledge, thereby reinforcing the skills acquired and implementing them effectively in the classroom.

CS#2 expresses his experience during their teacher training at university, highlighting a deficiency in instruction regarding the use of technology for teaching specific topics. Furthermore, he acknowledges his limited proficiency in utilizing technology for teaching and suggests forming learning communities as a solution. These communities would provide a platform for teachers to collaborate, share knowledge, and enhance their skills in integrating technology into their teaching practices effectively. Finally, he emphasizes the importance of addressing the gap in technological training for teachers through collaborative learning and skill reinforcement.

5.3. Data Analysis

The data presentation sheds light on the challenges and opportunities surrounding integrating technology into township classrooms in South Africa, particularly focusing on newly qualified teachers. The analysis reveals a complex interplay between factors that influence successful integration, including teacher preparedness, access to resources, professional development opportunities, and pedagogical approaches. The major themes that emerged include the following:

Uneven Integration of Digital technology in the classroom

The rapid rise of smart technologies in education offers exciting possibilities for improved teaching and learning. Integrating digital tools and internet access can expand the boundaries of educational experiences. However, for this integration to be truly meaningful, we need to understand how these technologies can support effective

teaching practices (pedagogical affordances). Digitalization opens doors to innovative approaches, but to unlock them, teachers must be equipped to leverage smart devices for enhanced learning (Mhlongo, Mbatha, Ramatsetse & Dlamini, 2023). Despite South Africa's education system being known for its inequality, equipping learners with high-quality education and the digital skills needed for the Fourth Industrial Revolution is crucial. However, a hurdle exists in teacher adoption of these modern practices. Many teachers are hesitant or resistant to move away from traditional methods, even though technology can significantly enhance teaching and learning (Hart, 2023). The research showed that some teachers embrace technology and implement innovative practices, others, still rely on traditional methods due to a lack of training. Studies suggest that digital technology can be a more effective teaching method by fostering a collaborative and interactive learning environment. This, in turn, can lead to improved learner achievement, increased attentiveness, and a more organized system for managing learning materials (Liaw & Huang, 2016).

Inadequate Teacher Training

Teacher training programs often fell short of equipping them with the necessary skills to integrate technology effectively. The lack of access to ongoing professional development opportunities that focus on updating skills and knowledge to align with the demands of the technological pedagogical require a solid technological foundation. The research data revealed that without regular training sessions or workshops, newly qualified in-service teachers struggle to stay updated on best practices and innovative teaching strategies. In a qualitative study by Fullan and Steigelbauer (2022), teachers expressed concerns about their ability to implement technology-rich lessons effectively without sufficient training and support from school leadership. While research by Hixon, Buckenmeyer, and Barczyk (2023) highlighted the importance of continuous professional development for teachers to enhance their technology integration skills and adapt to the changing educational landscape. Teacher training programs should integrate the use of digital technologies to prepare teachers for the 4IR teaching and learning environment. This will equip newly qualified teachers with the skills and knowledge to effectively implement technology in their classrooms.

From the data collected, it is apparent that the gap between theoretical knowledge and practical application of digital technologies in the classroom is huge. Inadequate training indeed contributes to teachers using outdated curriculum and instructional methods that do not align with the needs of the Fourth Industrial Revolution (4IR) classroom, a study by Soska, Gaydos, and Koehler (2021) found that many pre-service teachers felt unprepared to integrate technology effectively into their teaching due to limited exposure and training during their teacher education programs. It is evident that without proper training, newly qualified in-service teachers default to traditional instructional methods that focus on rote memorization and passive learning rather than fostering the skills needed for success in the 4IR. In addressing these challenges, it's crucial for education stakeholders to invest in comprehensive training and professional development programs that empower teachers with the knowledge, skills, and resources needed to thrive in the 4IR classroom. By prioritizing ongoing training, fostering a culture of innovation, and providing support at the institutional level, teachers can better meet the evolving needs of today's learners.

Limited Digital Technology Resources

Limited digital technology resources lead to a significant pedagogical gap, limiting the effectiveness of instruction and the ability of schools to prepare learners for a digital future. A major contributor of such a dilemma stem from the unequal distribution of funding for technological resources creating a digital divide. Research shows that learners from low socioeconomic status backgrounds are disproportionately affected by the digital divide (James R. Valadez, Richard P. Durán, 2007). They are denied the social and economic benefits that come with access to technology, denying them the opportunity for self-empowerment and reducing their chances of educational success. For example, learners who lack access to adequate digital technology in school may find it difficult to develop the digital literacy skills that are increasingly required in the job market. As the digital divide perpetuates, learners from low-income communities who do not have the opportunity to interact with current digital tools may struggle to compete with peers who have had such experiences. This could lead to fewer job opportunities and lower earning potential, contributing to the cycle of poverty.

E-learning teacher training has been fundamental to the teaching profession. Developing comprehensive and high-quality teachers is the most important professional development criterion. A recent study found that providing high-quality training can increase teachers' confidence in using digital resources in their curriculum. Investing in e-learning integration, including training, increases teachers' commitment to using digital resources (Razak, Rasli, Subhan, Ahmad, & Malik, 2023). Schools lack the budget for essential equipment or proper training to utilize available technology. The availability of digital technologies and the capacity to use them are increasingly recognized as components of socioeconomic development. The societal implications of the digital divide highlight the importance of ensuring equitable access to technology to facilitate the flow of information and services and thus contribute to the democratization of opportunities in the digital age.

Benefits of Communities of practices

The concept of Communities of Practice (CoPs) presents a promising solution for addressing challenges in integrating technology effectively into teaching and learning. CoPs provide a platform for teachers to share best practices, troubleshoot challenges, and cultivate a culture of innovation through collaboration. By engaging in CoPs, teachers can accelerate the successful integration of technology into their classrooms by learning from their peers' experiences and expertise. Research has shown that CoPs can enhance professional development, promote knowledge sharing, and facilitate ongoing support for teachers as they navigate the complexities of technology integration.

By harnessing the power of collaboration within communities of practice, schools and educational institutions indeed enhance teaching and learning in the digital age. As seen in the Metropolitan School District of Lawrence Township's Digital Age Literacy Initiative, teacher professional development is strongly emphasized through the integration of action research and self-assessment within an online professional development network (Twenty-first century learning in school systems: the case of the Metropolitan School District of Lawrence Township, Indianapolis, Indiana., 2006). Such collaboration within CoPs not only bolsters the professional growth of teachers but also the academic success of learners. Schlager and Fusco argue for the critical role that local CoPs play before even considering online extensions, as they are pivotal

in driving sustainable improvement in teaching methods (Schlager & Fusco, 2003). This community-driven approach leverages shared knowledge and experience to create more effective digital learning environments, ultimately fostering better educational outcomes. In Soweto township schools, employing CoPs is pivotal in incubating newly qualified teachers with technology integration in their lessons.

5.4. Discussion of the finding

The integration of pedagogical technology into the classroom setting has become increasingly important in contemporary education systems worldwide, including South African township schools. This is particularly crucial in under-resourced contexts where traditional methods may struggle to cater to diverse learning styles and knowledge gaps. Pedagogical technology, when effectively integrated, can enhance learning experiences by fostering interactive environments, promoting individualized instruction, and providing access to a wider range of educational resources. However, despite its potential, there are significant challenges in ensuring that newly qualified in-service teachers are adequately prepared to effectively utilize pedagogical technology in their teaching practices. It is crucial to acknowledge the digital divide that exists within South African township schools. While access to technology has improved in recent years, many schools still face infrastructural challenges such as unreliable internet connectivity, limited access to devices, and inadequate technical support. The extent of implementation of digital technologies in township schools remains uneven. Resource limitations, including inadequate infrastructure and unequal access to devices, hinder effective digital technology integration. As a result, newly qualified in-service teachers may lack the necessary resources and infrastructure to effectively incorporate technology into their teaching.

Moreover, there is often a gap between teachers' technological proficiency and their ability to integrate technology into pedagogy effectively. Many newly qualified teachers may be proficient in using technology for personal use but may lack the skills and knowledge to leverage it for educational purposes. The Curriculum Assessment Policy Statements (CAPS) and the Minimum Requirements for Teacher Education Qualifications (MRTEQ) documents in South Africa advocate for integrating digital technologies into classroom teaching. CAPS outlines learning objectives that can be enhanced through technology, while MRTEQ ensures teacher training equips teachers

with the skills to leverage these tools. Therefore, professional development programs must focus on building teachers' pedagogical knowledge of technology integration, including strategies for designing technology-enhanced lessons, assessing student learning using digital tools, and promoting digital citizenship. In addition to addressing technological and pedagogical competencies, it is essential to consider the socio-cultural context of South African township schools. These schools serve diverse student populations with varying linguistic, cultural, and socioeconomic backgrounds. Thus, it is imperative for teachers to adapt technology-enhanced instruction to meet the unique needs and interests of their learners. This may involve incorporating culturally relevant content, resources, and fostering inclusive learning environments.

Case studies of successful technology integration in South African township schools can provide valuable insights into effective practices and strategies. For example, research conducted by Chigona and Chigona (2017) explored the use of mobile learning apps to support mathematics instruction in a township school in Johannesburg. The study found that teachers who received targeted training and support were able to effectively integrate mobile learning apps into their teaching, leading to improved student engagement and academic performance. Similarly, a study by Govender and Govender (2019) investigated the implementation of a digital storytelling project in a rural KwaZulu-Natal school. The project aimed to enhance learners' language and literacy skills through the creation of digital stories using tablets and multimedia software. The findings demonstrated that teachers played a critical role in scaffolding learners' digital storytelling skills and fostering collaborative learning experiences. Township schools can achieve similar results by adopting these methods, but with a creative approach, tailoring them to their unique context. The research underscores the critical need for ongoing support and professional development for newly qualified teachers in South African township schools. This includes collaborative learning communities, mentoring programs, and access to relevant resources and training workshops. By addressing the technological, pedagogical, and socio-cultural dimensions of technology integration, teachers can better prepare teachers to effectively leverage technology to enhance teaching and learning outcomes in township schools.

Several governments took initiatives to ensure that South African schools are equipped with digital technologies to bridge the digital divide and empower township teachers to harness the potential of technology for their learners. The Department of Basic Education's (DBE) National Education Development Plan (NEDP) 2019-2024 outlines a vision for "quality and inclusive education for all" through technology integration (Department of Basic Education (DBE), 2019). This plan includes providing schools with tablets and computers loaded with approved educational content (DBE, 2019). Additionally, the DBE launched the "Vodacom e-School Project" in partnership with Vodacom to establish high-speed internet connectivity and equip schools with digital resources Department of Basic Education (DBE), 2019). However, these programs face significant hurdles. The OECD (2020) highlights the persistent digital divide in South Africa, where disparities in access to technology and the internet between urban and rural areas remain a challenge. Furthermore, teacher training often lacks a strong focus on digital pedagogy, hindering effective technology integration in classrooms (Dlamini, 2020). These limitations necessitate ongoing efforts to bridge the digital divide, provide targeted professional development for teachers, and ensure equitable access to technology across all schools, particularly in townships. Activity Theory (AT) can be a valuable tool to be used by newly qualified in-service teachers in South African townships. It may help them to develop their readiness for pedagogical technology use.

By examining case studies of township schools through an AT lens (Engeström, 2008), researchers can analyse the interplay between various elements that influence pedagogical technology process. The AT framework considers the Subject (teacher), Object (pedagogical technology use), Tools (available technology and resources), Rules (school policies and curriculum guidelines), Community (teacher colleagues and professional networks), and the Division of Labor (collaboration and support structures). Case studies can reveal how these elements interact within each school context. For instance, a teacher facing limited technological resources (Tools) might collaborate with colleagues (Community) to develop creative solutions, highlighting the importance of social interaction in overcoming limitations. Through in-depth analysis of such cases, researchers can identify factors that either hinder or support the development of newly qualified teachers' readiness for technology integration in township classrooms.

5.5. Conclusion

The chapter extracted meaning from the collected qualitative data. Through a thorough examination and employment of diverse analytical methods, the data discerned persistent patterns, themes, and significant insights within the experiences of teachers. The data presentation delved beyond the surface, offering a holistic understanding of the complexities surrounding newly qualified teachers' technology adoption within Soweto classrooms. Notably, the chapter explored the interplay between pedagogical approaches, teacher readiness, professional development opportunities, and the potential influence of communities of practice. This analysis culminated in a central finding - the seemingly slow technology integration despite teacher qualifications and 4IR resource availability.

Chapter: Conclusion, Limitations and Recommendations

This research delved into the readiness of newly qualified, in-service teachers within South Africa to incorporate educational technology into their instruction. Utilizing the case study method, the research illuminated the various obstacles and prospects encountered by these instructors. The findings hold significant value for informing teacher training programs, resource allocation, and support structures aimed at empowering teachers to harness the transformative potential of technology for both them and their learners. The exploration of teachers' experiences contributes to paving the way for a future where technology serves as a powerful tool for both teachers and learners within township schools.

The research applied a qualitative approach using a case study design to explore how newly qualified, in-service teachers in township schools integrate digital technologies

into their classrooms. Data collection methods included in-depth interviews. Thematic analysis was used to identify patterns and themes within the data, revealing the subjective experiences, and challenges faced by these teachers. This interpretivist approach prioritizes understanding their lived experiences and the factors influencing their technology integration practices. The findings of this research provided valuable insights for teacher training programs, curriculum development, and school leadership practices, ultimately promoting effective and inclusive learning environments that leverage the potential of digital technologies for all learners. The data analysis revealed a complex interplay between factors influencing technology integration in South African township classrooms, particularly for newly qualified teachers. Uneven access to resources, inadequate training, and the digital divide create significant challenges. However, opportunities exist to bridge these gaps. It was suggested that using frameworks like Activity Theory can offer deeper insights into how newly qualified teachers navigate technology integration within specific school contexts.

6.1. Response to the findings

The study responds to the research questions as follows:

How do newly qualified in-service teachers integrate digital technology in their subject content that the 4IR space prefers?

Newly qualified teachers integrating digital technology in their classrooms for the 4IR space face challenges. While some may embrace innovative practices, many lack the training and resources. Teacher training programs need to bridge the gap by equipping them with skills for technology integration in their subjects.

How well-prepared are newly qualified in-service teachers to use pedagogical technology in the classroom?

While newly qualified teachers may possess personal technology skills, research suggests they often lack the specific training and knowledge to integrate technology effectively into their teaching. Uneven access to resources and a persistent digital divide further hinders their readiness.

What strategies could newly qualified in-service teachers use to accelerate the integration of digital technology in the classroom?

Newly qualified teachers can accelerate technology integration by seeking out ongoing professional development focused on pedagogical uses of technology. Joining Communities of Practice allows them to collaborate with experienced teachers and share best practices. Additionally, they can leverage freely available online resources and adapt them to their specific curriculum and student needs. By focusing on these strategies, new teachers can overcome initial hurdles and confidently utilize technology to enhance learning in their classrooms.

Despite having the qualifications and access to 4IR resources, why do newly trained in-service teachers adopt/use technology in their practice so slowly?

Despite qualifications and access, newly qualified teachers may integrate technology slowly due to factors such as a lack of training in effective pedagogical uses of technology, limited experience teaching with these tools, and the challenges of navigating the digital divide within their classrooms. Furthermore, some teachers feel pressure to stick to established methods or lack the confidence to experiment with new technologies.

6.2. Limitations of the Study

While case studies of township schools offer valuable insights into the challenges faced by newly qualified teachers integrating technology, this research approach has limitations. The specific experiences of a few schools may not be generalizable to the broader context of all South African townships. Additionally, case studies often relied on self-reported data from teachers, which could be subjective and susceptible to bias. Furthermore, the research could not capture the wider systemic factors, like national curriculum guidelines or national professional development programmes, that influenced teacher practices across the country. Acknowledging these limitations is crucial for interpreting findings accurately and providing valuable insights for future research directions. To gain a more comprehensive understanding, this research could be complemented by larger-scale surveys or interviews with teachers from a wider range of township schools.

6.3. Recommendations

The study recommends the following:

- The importance of pedagogy-focused professional development equipping teachers with skills to integrate technology meaningfully into their lessons.
- Fostering collaborative learning communities can provide ongoing support and knowledge sharing among teachers.
- Addressing the digital divide through initiatives ensuring equitable access to resources and reliable internet is crucial.

By prioritizing these recommendations, teacher training programs and school leadership can empower newly qualified teachers to leverage technology effectively for improved teaching and learning outcomes in township classrooms.

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Appendix A: ETHICS APPROVAL



SCHOOL OF EDUCATION ETHICS COMMITTEE

CONSTITUTED UNDER THE UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)

CLEARANCE CERTIFICATE

PROTOCOL NUMBER: 2023ECE067M

PROJECT TITLE

Newly qualified in-service teachers' readiness for pedagogical technology use in the classroom: case studies of township schools

INVESTIGATOR

Naledi Vilakazi

SCHOOL/DEPARTMENT OF INVESTIGATOR

Wits School of Education

DATE CONSIDERED

15 September 2023

DECISION OF THE COMMITTEE

Approved unconditionally

RISK LEVEL

Minimal risk

EXPIRY DATE

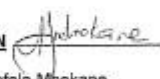
Date of submission of the Research Report

ISSUE DATE OF CERTIFICATE

27 September 2023

cc: Dr Ailton Dewa

CHAIRPERSON


Dr. Batseba Mofolo-Mbokane

DECLARATION OF INVESTIGATOR

To be completed in duplicate and **ONE COPY** returned to the Chairperson of the School/Department ethics committee.

I fully understand the conditions under which I am authorized to carry out the abovementioned research and I guarantee to ensure compliance with these conditions. Should any departure be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee.


Signature

Date 27, 09, 2023

Appendix B: GDE APPROVAL



GAUTENG PROVINCE

Department: Education
REPUBLIC OF SOUTH AFRICA

814141112

GDE RESEARCH APPROVAL LETTER

Date:	15 August 2023
Validity of Research Approval:	08 February 2023-30 September 2023 2023/345
Name of Researcher:	Vilakazi N
Address of Researcher:	30 Cloverdene Road Rynfield/Benoni
Telephone Number:	0735084035
Email address:	1434130@students.wits.ac.za
Research Topic:	Newly qualified in-service teachers' readiness for pedagogical technology use in the classroom: case studies of townshi schools
Name of University:	University of the Witwatersrand
Type of qualification	Masters
Number and type of schools:	2 Primary Schools,3 Secondary Schools
District/s/HO	Gauteng East, Johannesburg Central

Re: Approval in Respect of Request to Conduct Research

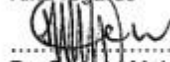
This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Princ• I and SGB) and the District/Head Office Senior Manager confirming that permission ha ranted for the research to be conducted.

The following conditions apply to GDE tch. The res arch r may proceed with the above study subject to the conditions I ted 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.
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 the relaxation of COVID 19 regulations researchers can collect data online, telephonically, physically access schools 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.
4. The Researchers are advised to wear a mask at all times, Social distance at all times, Provide a vaccination certificate or negative COVID-19 test, not older than 72 hours, and Sanitise frequently.
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



Dr. Gurnani Mukatuni

Acting CES: Education Research and Knowledge Management

Name of University:	University of the Witwatersrand
Type of qualification	Masters
Number and type of schools:	2 Primary Schools, 3 Secondary Schools
District's/HO	Gauteng East, Johannesburg Central

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.

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.

Making education a societal priority

1

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

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 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


Dr. Gertie Mukatuni
Acting CES: Education Research and Knowledge Management

DATE: 15/08/2023

Making education a societal priority

2

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: CONSENT FORM



Consent Form for Teacher Participation in the study

Title of project: Newly qualified in-service teachers' readiness for pedagogical technology use in the classroom: case studies of township schools

Name of researcher: Naledi Vilakazi

I,, agree to participate in this research project.

I agree to the following:

(Please circle the relevant options below)

The research study was explained to me. I understand what this study is about.	YES	NO
I understand that I can volunteer to take part in the study	YES	NO
I agree that the interview/focus group/other activity may be audio recorded	YES	NO
I agree that direct quotations from my interview/focus group/other activity may be used by the researcher in their research report/manuscript/book chapter	YES	NO
I agree that my participation will remain anonymous (my name will not be used by the researcher in their research report/manuscript/book chapter)	YES	NO
I agree that other researchers may use the information I provide in my interview/focus group/other activity (depending on their own ethics clearance being obtained) but my name and any personal information will not be used or passed on	YES	NO

..... (signature)
..... (name of participant)
..... (date)



Naledi Vilakazi
02 August 2023

APPENDIX D: PERMISSION FORM



University of the Witwatersrand,
Wits School of Education
Division of Science and Technology
27 St. Andrews Road, Parktown
011 717 3007

The Principal
707 Cor Etosha and Gabon Street
Chief Albert Luthuli Park
Benoni
1513

02 August 2023

Dear Sir/Madam,

Re: Permission to conduct research at Chief Albert Luthuli Secondary School

My name is Naledi Vilakazi (Student numbers: 1434130)

I am studying for a Master of Education (M.Ed.) in the Wits School of Education at the University of the Witwatersrand. I am seeking permission to do research at Chief Albert Luthuli Secondary School.

I am conducting research titled *Newly qualified in-service teachers' readiness for pedagogical technology use in the classroom: case studies of township schools*. There is limited use of ICT integration in teaching and learning during classrooms by newly qualified in-service teachers to prepare learners for the 4IR terrain (Yu, 2022). Educating the "net generation" of learners requires technological pedagogy that facilitates practical and effective learning (constructivism and pragmatism). John Dewey theory suggested that for effective learning to be realized, it should be implemented through social interactions with the environment and the school setting should be a social institution whereby learners interact physically or through the use of digital technologies (virtually) (Williams, 2017).

Despite the proposition of John Dewey's philosophy of pragmatism newly qualified in-service teachers rarely use digital technology for pedagogical instruction in their practice (Shafie et al, 2019). The teaching method seems to be a misfit in the 4IR space, it is just like putting a round peg in a square hole. Technology platforms provide affordances in teaching and learning as they have inherent simulation and modelling properties. Teaching using simulation and modelling enhances learner understanding of the concept taught (Maringa & Chiramba, 2022). The Department of Education in South Africa encourages all schools and teachers thereof to use or embrace use of technology in lesson delivery to enhance learning. The research aims at it proposing possible solutions that may help in-service teachers to integrate digital technology into their teaching. This includes appropriate training and workshops that align with pedagogical use of technology integration in the classroom.

The research will entail collecting data from your teaching staff. The individual staff will be interviewed for at least 30 minutes after school hours at their convenient locations. The participants response will be audio recorded.

Participants will be asked to give their written or verbal consent before the research begins. Their responses will be treated confidentially, and identities (their names and the name of the organisation) will be anonymous unless otherwise expressly indicated. Individual privacy will be maintained in all published and written data resulting from the study.

The results will be communicated in the research dissertation.

The research participants will not be advantaged or disadvantaged in any way. They will be reassured that they can withdraw their permission at any time during this project without any penalty. There are no foreseeable risks in participating in this study. [If there are risks, these must be clearly stated.] The participants will not be paid for this study.

All research data will be destroyed after three (3) years.

I therefore request permission in writing to conduct my research at your organisation. The permission letter should be on your ~~organisation's~~ headed paper, signed and dated, and specifically referring to myself by name and the title of my study.

Please let me know if you require any further information. I look forward to your response as soon as is convenient.

Yours sincerely,
Naledi Vilakazi
073-508-4035
1434130@students.wits.ac.za

Alton Dewa
011 717 3337
Alton.dewa@wits.ac.za

APPENDIX E: RESEARCH QUESTIONS

Semi-Structured Interview Questions

I am conducting research entitled: *Newly qualified in-service teachers' readiness for pedagogical technology use in the classroom: case studies of township schools.*

I would like to invite you to participate in a semi-structured interview with the following questions:

1. How do you as a newly qualified in-service teacher integrate digital technology in your subject content?

2. We are living in an era that is dominated by digital technology and the department of education encourages us to use them in your lesson delivery. What is your level of competent towards use of these digital tools?

3. How does your school help in preparing you to use these digital tools in your lessons? Furthermore, if your school is not supporting you, how do you intend to upskill yourself towards digital terrain?

- _____
- _____
- _____
4. What challenges do you and your school encounter pertaining the use of digital tools in teaching and learning?

- _____
- _____
- _____
5. We are living in the world that is so called 4IR, how do you think this terrain we are in can accelerate or influence the adoption of teaching and learning that use digital technologies?

Thank You!

APPENDIX F: REPORT

N. Vilakazi M.Ed. Final Research Report.docx

ORIGINALITY REPORT

12%	9%	8%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

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4	Schultz, Susan Lee. "ICT-CAR: A Model of Professional Development.", Proquest, 2015. Publication	<1%
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