An Investigation into the Integration of Digital Technology in Teacher Development for Enhanced Inclusion

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Abstract

Keywords: *Inclusion, teacher training, technology integration, digital education*

The study addresses the problem of insufficient teacher training for technology integration in inclusive classrooms, and professional development opportunities. Prior research highlights barriers such as limited access, lack of confidence, and insufficient contextualised training, which hinder effective adoption. This research investigates the integration of digital technologies in teacher development to enhance inclusion within a South African all-girls school. It explores the intersection of digital tools, inclusive education practices, and teacher agency, employing Margaret Archer's theory of social realism.

This study is significant in the context of growing demands for inclusive, technology-enabled education to address diverse learning needs. Using a design-based research approach, the research involved a case study, interviews, and surveys with teachers and subject heads to examine structural and cultural enablers and barriers, as well as teacher agency in using digital technologies. Data was collected over four phases, encompassing initial problem analysis, interventions, and the development of design principles.

Findings reveal that structural factors such as infrastructure and training availability significantly impact technology adoption, while cultural factors like school norms and professional autonomy influence teachers' willingness to innovate. Teachers who exhibited higher agency adapted digital tools to create inclusive practices, leveraging technologies like interactive whiteboards and assistive tools to address diverse learner needs.

The study contributes to understanding the interplay between structure, culture, and agency in educational contexts. It underscores the importance of targeted professional development and context-aware strategies to overcome barriers. The implications suggest that fostering teacher agency and integrating culturally relevant technologies are pivotal for advancing inclusive education. Future recommendations include enhanced training programmes and systemic reforms to embed inclusivity in teacher practices and institutional policies. This research provides a framework for scaling inclusive, technology-driven approaches in diverse educational settings.

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List of Abbreviations and Acronyms

AI	Artificial Intelligence
AT	Assistive Technology
AR	Augmented Reality
CK	Content Knowledge (TPACK)
CTLI	Cape Teaching and Leadership Institute
DBE	Department of Basic Education
GAI	Generative Artificial Intelligence
ICT	Information and Communications Technology
IWB	Interactive Whiteboard
LD	Learning Disability
MOOCs	Massive Open Online Courses
OER	Open Education Resources
PK	Pedagogical Knowledge (TPACK)
PST	Pre-Service Teacher
PWD	Persons with Disability
SACE	South African Council for Educators
TAM	Technology Acceptance Model

TK	Technology Knowledge (TPACK)
TPACK	Technological, Pedagogical and Content Knowledge
VBL	Video-Based Learning
VFL	Video-Based Flipped Learning
VR	Virtual Reality

Chapter 1: Introduction

1.1 Background to the study

Digital technology is used in every part of modern life, including education. This study focuses on how digital technologies can be harnessed in education to enhance teaching and learning, and it has the potential to enable inclusive education. It explores what inclusion in education encompasses and how digital technologies can be used to create inclusive environments. This study explores how teachers currently use digital technologies in their classrooms, how learners' needs are met through these technologies, and the development opportunities they have available to them. In this study, digital technologies are defined as technologies (existing, new, and emerging) that are not limited to devices (smartphones and wearables) and include analytical procedures (such as machine learning and Artificial Intelligence [AI]) that enhance learning and transforming the classroom (Salas-Pilco et al., 2022).

This study takes place in the Western Cape in South Africa in an all-girls school. The school is an independent school consisting of a preparatory school and a senior school. These schools are on a joint campus but there is little interaction between the learners and teachers of the two school sites. As an independent school, the school management can make changes to how the school is managed, what subjects are offered and the curriculum followed more easily than a government school.

In 2001, the South African Government implemented inclusive education policies to place emphasis on accommodating diverse learners in existing schools. They categorised schools into three types: special, full-service, and ordinary. Special schools are equipped to serve learners requiring intense support, whereas full-service schools host all learners and address learning barriers (Department of Education, 2001). Ordinary schools continue to serve learners with mainstream requirements. While many regular schools are transitioning into full-service schools, teachers potentially lack the essential skills and knowledge required to effectively create and sustain an inclusive environment (Department of Education, 2001). The Department of Basic Education (DBE) asserts that schools (and teachers) should provide various levels and kinds of support to learners (Department of Education, 2001). The DBE also recognises diversity among learners, acknowledging their unique learning needs that should be respected and addressed (Department of Education, 2001). According to the DBE, educators should possess the requisite skills and knowledge to successfully implement inclusion (Department of Education, 2001). Teachers need multilevel classroom instruction, cooperative learning, and problem-solving skills to develop learners' strengths and competencies. Teachers must be developed into the best teachers through access to appropriate development initiatives (Head & Taylor, 1997). For teachers to be most effective at using digital technologies to create inclusive learning environments, they need authentic professional development that reflects the reality of their teaching context. By including culturally contextualised digital technology, the advantages of AI and new technologies can be realised (Salas-Pilco et al., 2022).

1.1.1 Digital technologies in education

This review of digital technologies in education will look at the last 30 years since 1994, since the first democratic elections in South Africa. Investment in educational digital technologies has increased globally but the adoption rate has not increased (Weller, 2018). This means that there has not been the integration and impact expected from educational technologies. The adoption of technology in the classroom means that teachers choose to use an innovation, as they view it as the best course of action (Buabeng-Andoh, 2012). For integration, teachers need to choose the innovation, for example, digital technologies, and then ensure that this innovation connects to the whole system, the content, and the pedagogy and is used together (Buabeng-Andoh, 2012). Integration is not showing a YouTube video in class or providing the learners with a list of sites to access. Integration occurs when teachers can determine which tool will meet their objective best and use that tool as part of their pedagogy and not as an add-on. When teachers can incorporate technology to assist in achieving their learning objectives, they have better engagement with the tool and content.

Technology was introduced into education in the 1950s through instructional television but it really only started to find its way into classrooms with the invention of cheaper desktop computers in the late 1970s (Aslan & Reigeluth, 2011). Between 1970 and the 1990s, microcomputers gained popularity in schools and became part of daily life both within and beyond educational settings, and with the advent of the internet in education, the use of educational technologies significantly accelerated (Aslan & Reigeluth, 2011). To understand how digital technologies have been developed for education over the last 30 years, the period starting with the early internet will be explored. Wikis were one of the first educational technologies to be developed in 1994, with their breakthrough into more mainstream use coming in 1998 (Weller, 2018). Wikis are content resources that can be accessed by anyone and allow for a shared and collaborative way of accessing information (Weller, 2018). Although Wikis showed great promise, they were not used in teaching as expected. The late 1990s and early 2000s saw key developments in educational digital technologies in the form of the learning management system (McGravey, n.d.) through to open courseware (*MIT OpenCourseWare*, n.d.) and the emergence of e-learning material, which allowed for the digital distribution of course materials. In 1999, conventional and distance universities began to move their content from the traditional mode of delivery to an e-learning mode of delivery (Weller, 2018). Initially universities assumed the cost of delivery would decrease in the new mode, but this was not the case and costs shifted into the development of e-learning material that met the new standards and approaches (Weller, 2018).

Based on these developments in connectivity, a greater emphasis was placed on new forms of education in science, technology, engineering and mathematics (STEM) (Christensen, 2019). Learning objects began to be developed in 2000 owing to the new mode of delivery. These learning objects were reusable pieces of content or learning artefacts that could be reused and referenced to support learning across multiple spaces (Weller, 2018). Learning objects have been slow to take off, as they require a different way of using learning material, and in many spaces, they are over-engineered (Weller, 2018). 2001 saw the launch of e-learning standards and MITs OpenCourseWare initiative (Weller, 2018; *MIT OpenCourseWare*, n.d.). E-learning standards allowed for the professionalisation of the industry and helped to decrease costs, as content types, assessment, and learning design could be developed in advance and fit into a predesigned system (Weller, 2018). With the launch of MIT's OpenCourseWare, came more Open Education Resources (OER) where course content was made available to all for free under a new type of licensing (Weller, 2018). Teachers and textbooks no longer

had the monopoly on content, requiring a shift in how content was delivered and facilitated (Aslan & Reigeluth, 2011). Even though here has been a change in the role of teachers, there has been a slow uptake of OER due to several factors, such as sustainability, systemic organisational issues, pedagogical practices and quality control (Cox, 2016).

In the late 1990s, the Interactive Whiteboard (IWB) was developed, and by the early 2000s, was being used in classrooms around the world (Betcher & Lee, 2009). This was a revolutionary tool, as it was the first electronic instructional technology designed specifically for use by teachers in the classroom rather than for general use and adapted to the classroom (Betcher & Lee, 2009). Teachers can use IWBs to teach in a manner that they are comfortable with and over time to assist the teacher by integrating additional technology (Betcher & Lee, 2009). The IWB allows other technologies to enter the classroom. Initially, this was video. YouTube was created in 2005 which allowed anyone to create content in the form of videos (Weller, 2018). This meant that teachers could create instructional videos using their content, share videos with learners, and share videos of other people through their IWBs.

The rise of Web 2.0 in 2006 allowed for more interactive, user-generated content to be shared through blogs, wikis, and social media platforms (Weller, 2018). These collaborative spaces allowed for social interactions between users and the construction of knowledge (Aslan & Reigeluth, 2011). This collaborative learning space has raised some issues regarding the type of content being uploaded, as it needs to be critically analysed by the user and not verified by the creator (Weller, 2018). Web 2.0, which gave rise to Second Life and Virtual Worlds in 2007, allows educational programmes to be delivered in a virtual environment (Weller, 2018). In 2008 Khan Academy was launched to provide free, world-class education to anyone, anywhere (Khan, n.d.) The provision of free online tutorials and lessons has accelerated the trend of self-paced learning. In response to the need to provide self- paced learning environments, Massive Open Online Courses (MOOCs) with platforms such as Coursera and Udacity began to provide access to high-quality education at scale in 2010 (Weller, 2018). This has made higher education more accessible in a global context. In the early 2010s, Augmented Reality (AR) and Virtual Reality (VR) technologies started to gain attention in the educational space as they allowed teachers to “bring the real world into the classroom” (Al-Ansi et al., 2023). In 2014, Google Classroom was released (*Google Blog*, n.d.) with Microsoft releasing 365 for Education in 2017 (*Microsoft for Education*, n.d.), which allowed teachers and learners to collaborate and store learning material more effectively with cloud-based applications and adaptive learning platforms making personalised learning more accessible.

In 2016 Artificial Intelligence (AI) began to influence education using tools such as chatbots and adaptive learning systems that provide personalised feedback (Furze, 2024). With all the growth in the educational technology space, learning analytics became more common between 2017 and 2020, helping educators track and optimise learner performance through data-driven insights (Soncin & Cannistrà, 2022). In 2020, the Covid-19 pandemic forced a massive shift to online learning with school closures and classes moving online (Xhaferi & Xhaferi, 2020). This shift has allowed for the rise in development of a whole range of new tools including new virtual learning spaces such as Minecraft Education for immersive, interactive learning experiences (Slattery et al., 2023). In 2023, AI-driven personalised learning continued to advance, with AI tools such as ChatGPT being integrated into learning platforms to assist with content creation, tutoring, and learner engagement (Furze, 2024).

The integration of AI, VR, and AR has continued to expand with immersive learning environments becoming more accessible and sophisticated. Gamification, adaptive learning, and real-time data analytics are becoming core components of educational technologies that cater to diverse learning needs and preferences (Haleem et al., 2022).

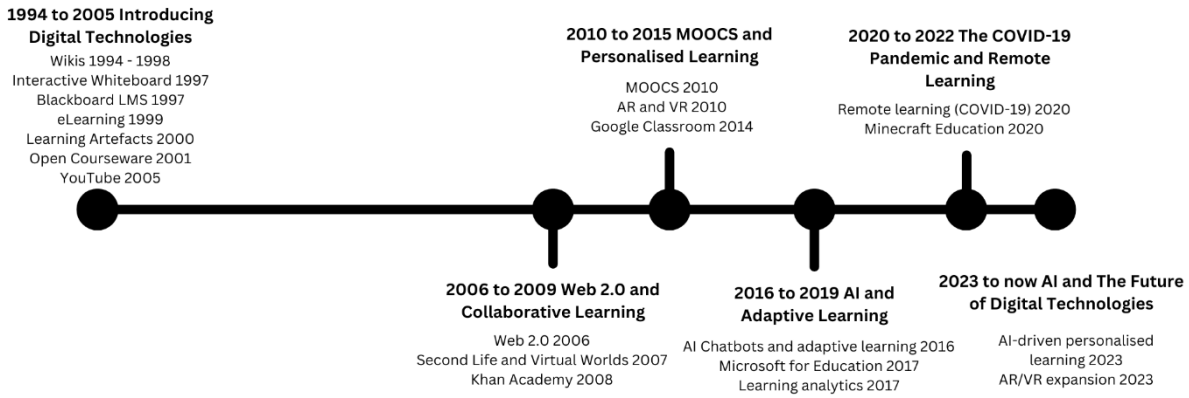

Figure 1: Digital technologies timeline

Rapid changes in digital technologies have been experienced globally and to a more limited extent in South Africa (Figure 1). According to Hoosen (2023), academics in South African educational institutions teach the way they were taught and therefore fail to shift teaching practices to integrate digital technologies into learning experiences. Even when educational institutions provide the digital technology and connectivity, there is low uptake of the available edtech (Hoosen, 2023). Due to the uneven educational landscape in South Africa, institutions have approached the integration of digital technologies differently (Ng'ambi et al., 2016). This has resulted in IWB, AR and VR and other digital technologies being used unevenly across schools in South Africa and lagging behind the rest of the world.

1.1.2 Inclusive education

Many factors can cause exclusion in schools. Learners are excluded based on their financial, physical, social and cognitive abilities (Kern, 2020). Some learning difficulties that are catered for include dyslexia, dyscalculia, dysgraphia, attention deficit hyperactivity disorder (ADHD), language processing disorder, nonverbal learning disorder and visual perceptual/visual motor deficit (Walden University, n.d.). To create an inclusive environment, teachers need to accept that each person for who they are, despite looking different, having different needs or having different ways of thinking (Engelbrecht & Swanepoel, 2013). Neurodivergent learners require different support in the classroom than neurotypical learners (Cinquin et al., 2019).

In South Africa, the DBE specifies how schools should be established to accommodate neurodivergent learners (Department of Education, 2001). Schools are either set up as mainstream or inclusive schools. The DBE defines mainstreaming as when learners are made to 'fit-in' with the focus being on changing the learner to suit the environment and integrate into the 'normal' school (Department of Education, 2001). An inclusive school is one where teachers recognise and respect the child as a person first rather than the barrier they face, and then create the best learning environment for that learner (Engelbrecht & Swanepoel, 2013). Creating inclusive learning environments for all learners at all

educational levels is essential (Perelmutter et al., 2017). Digital technology has been developed to assist learners who have learning difficulties. It is important to review how these technologies impact the creation of authentic learning environments – and learning itself – when implemented in the classroom (Perelmutter et al., 2017).

Implementing inclusive teaching practices and introducing new digital technologies is a struggle in the South African context, where teachers do not have the conceptual knowledge they require to teach foundational concepts (Christiansen & Bertram, 2019). To achieve inclusion, teachers need to be equipped with the right skills and knowledge to create multi-level classroom instruction, cooperative learning, problem solving, and develop individual learners' strengths (Department of Education, 2001). Christiansen and Bertram (2019) found that teacher training assumes prior content and environmental knowledge that is not present. In most cases, pre-service teachers have little or no experience with learners with learning difficulties (Krischler & Pit-ten Cate, 2019). Therefore, most teachers are not equipped to create inclusive learning environments because of gaps in their knowledge and skills (Department of Education, 2001).

1.2 Statement of the problem

Teachers are not adequately trained to integrate digital technology into their teaching practices, which limits their ability to create inclusive learning environments. Krischler and Pit-ten Cate (2019) argue that many teachers lack the necessary training to understand how to incorporate digital technologies effectively, or to identify which tools are most suitable for supporting diverse learners. Despite requirements in South Africa for teachers to complete 80 hours of in-service training annually (Department of Education, 2001), this training often does not adequately address the integration of digital technology. Furthermore, Christiansen and Bertram (2029) highlight that teachers are expected to use digital tools effectively within their specific content areas and to understand how technology can assist learners with learning difficulties. However, Krischler and Pit-ten Cate (2019) suggest that this expectation is not met in practice, as many educators lack the skills and knowledge necessary for such integration. This gap in teacher preparedness is particularly concerning given that cognitive impairments are a leading cause of school exclusion (Cinquin et al., 2019).

The evidence indicates that while policies mandate professional development, the training provided often fails to equip teachers with the practical skills required for technological integration in inclusive settings. This gap is problematic because learners with cognitive impairments face significant barriers to participation without appropriate technological support. For instance, assistive tools designed for learners with dyslexia or slow processing can only be effective if teachers are knowledgeable about their application. When this understanding is absent, the potential for these technologies to create equitable learning environments remains unrealised. Addressing these training gaps is critical to ensuring that teachers are empowered to integrate digital technology into inclusive practices. This requires a shift towards targeted professional development that aligns with teachers' subject- specific needs, and the demands of inclusive education, to ensure teachers are equipped to choose, and use, available digital technologies.

1.3 Purpose of the study

The purpose of this study was to understand how digital technologies have been integrated into the South African education system and how this integration into teaching and learning has created inclusive learning environments. Using Margaret Archer's social realist theory of the relationship between structure, culture and agency through the Morphostatic/Morphogenic approach, this study explores the complex interplay of factors influencing teachers' adoption of digital technologies for inclusion (2000, 2003, 2020). Archer's framework provides a lens through which to analyse 'structural' dimensions, such as school infrastructure and in-service training opportunities, that either support or limit the use of digital tools in creating inclusive environments.

The cultural dimensions of schools, such as the degree of professional autonomy afforded to teachers and how these cultural factors impact teachers' willingness to experiment with digital technologies in ways that enhance their inclusivity, are considered. The mediation of the relationship between structural and cultural factors with individual teacher agency can shed light on why some educators advocate for digital inclusion, navigating challenges, and leveraging digital tools to support neurodivergent and other diverse learners. By examining these factors through Archer's theoretical framework, this study aims to provide a deeper understanding of how structural conditions, school culture, and individual agency collectively shape the integration of digital technologies in support of inclusive education practices.

1.4 Research questions

How does teacher training and structure, culture and agency influence digital technology integration and inclusive education?

Secondary questions:

- *What are the structural and cultural barriers and enablers to the use of digital technology in the classroom?*
- *What agency do teachers display in relation to using digital technologies in the classroom?*
- *How does digital technology enable inclusive education?*

To answer these questions, this study employs a qualitative, case study approach to explore how digital technologies are integrated into an independent school in South Africa to support inclusive learning. The design-based research (DBR) methodology underpins this work, structured to iteratively analyse and address teachers' needs regarding digital technology use for inclusion. Data collection combines surveys, interviews and intervention sessions, with each phase designed to engage teachers at various stages of digital proficiency and inclusive practice development. Participants, including subject heads and identified super-users of digital tools, were selected based on experience and engagement with technology. Data was gathered through structured and unstructured interviews, group workshops and classroom observations, ensuring a comprehensive perspective on how digital technologies impact inclusive practices. Data analysis employed constant comparison analysis, allowing for thematic exploration of responses, identification of challenges, and evaluation of successes. This iterative approach facilitated the development of design principles for effective digital inclusion strategies, guided by social realism, to understand the structural and cultural factors shaping teachers' agency.

1.5 Significance of the study

The significance of this study lies in the increasing need for today's learners to develop proficiency in digital tools and practices, which are essential for success in the modern world. Todays' graduates need not only *familiarity* with digital tools and practices but *mastery,* in order to be successful in the future (Afzal et al., 2023). For learners to develop this proficiency, it is crucial that teachers are equipped not only with the technological tools but also with the pedagogical strategies necessary to use these tools effectively. This research aims to address the gap in teachers' preparedness to use digital technologies for inclusive education by exploring the barriers and enablers within the structural and cultural contexts of schools, as well as the agency exhibited by teachers in this regard. Through this exploration, the study seeks to contribute to the development of strategies that can support teachers in fostering more inclusive educational environments using digital technologies.

1.6 Organisation of the thesis

I began this study by reviewing literature in an international, national and school context, highlighting how digital technologies are being integrated and what digital technology integration means in the classroom. Through the literature review, I explored the concept and application of digital technology and inclusion in a classroom environment. The selected theory, social realism, assists in exploring and understanding digital technology integration and inclusion through the lens of structure, culture and agency.

The research followed a qualitative case study approach to collect and analyse data. This included formal and informal interventions with senior school teachers, interviews with selected subject heads and IWB super-users from the senior school. The interventions were run as in-person, whole-school workshops, as well as small staff development groups across the senior school. Subject head interviews were concluded one-on-one with each subject head. The IWB super-users were trained as a group to use the IWB and then debriefed in small groups to feedback on the training and use of the board in the classroom environment.

When presenting the findings, I began with an overview of the senior and preparatory school teacher interview responses and then explored the senior school teacher's responses in more detail to explore what digital tools are used in the senior school, and the frequency of their use. The findings explore how inclusion is understood in the senior school and the inclusive practices in place. The analysis of the interviews showed how each subject is approaching the integration of digital technologies, how inclusive practices are developed and the challenges faced. The interviews with the super-users allowed me to explore the role of the individual teacher in implementing new technology in a specific content area.

The discussion included how the findings and the literature came together in answering the questions posed at the start of the research. This allowed me to show how digital technologies are implemented, their influence on inclusion, and the role that structure, culture and agency play in the case study school. I conclude my dissertation with a summary of my findings and recommendations.

1.7 Conclusion

This chapter provided an overview of the context in which this study is situated, with particular attention to the role of digital technologies in the field of education. It examined how technological advancements are influencing teaching and learning practices, and highlighted the increasing importance of digital competence among educators. Additionally, the chapter outlined the purpose of the research, which is to explore how educational technology can be leveraged to create more inclusive learning environments. The chapter presented the central research question that guides this study, setting the foundation for subsequent analysis. The next chapter will build on this contextual groundwork by reviewing the current body of literature relevant to the topic. It will examine key themes, debates and gaps in existing research, and will introduce the theoretical framework that underpins the study, thereby providing a conceptual lens through which the findings will be interpreted.

Chapter 2: Literature Review

2.1 Introduction

Educational technology has evolved rapidly over the past two decades, profoundly impacting teaching and learning environments. Evaluating existing research on the role of digital technology in fostering inclusive learning environments is essential, particularly within the context of primary and secondary education in South Africa and other comparable educational systems. The review of the literature focuses on the challenges and barriers identified in previous studies, as to the integration of technology into the classroom. The review also looks at what evidence currently exists regarding the effectiveness of digital technologies in improving inclusion in the classroom. The literature included in this review was selected based on its relevance to the research questions, publication in peer-reviewed journals, and contribution to the understanding of educational technology in inclusive settings. Sources were identified through comprehensive searches in academic databases such as ERIC, PubMed, and Google Scholar. The search was limited to research published in English between 2000 and 2024.

2.2 Definitions of terms

Inclusive Education: Inclusive education focuses on recognising and respecting the differences among learners; supporting all learners, educators and the system so that the full range of learning needs are met; and focusing on the adaptation of systems in the classroom to overcome barriers that prevent learning needs being met (Department of Education, 2001). Inclusive education "is not about helping people to fit in, it's about helping the school change, to become a place where everybody fits in" (Wray et al., 2018, p. 42).

Digital Technologies: All technologies (existing, new and emerging) not limited to devices (smartphones and wearables) and including analytical procedures (such as machine learning and AI) that enhance learning and transform the classroom (Salas-Pilco et al., 2022).

Pre-Service Teachers: Pre-Service teachers are teachers who are still in training and have not yet completed their teaching qualification.

In-Service Teachers: In-Service teachers are teachers who have completed their teaching qualification and are employed at a school.

Assistive Technologies: Assistive technologies can be defined as "any item, piece of equipment or product system, whether acquired commercially off the shelf, modified or customised, which is used to increase, maintain or improve functional capabilities of individuals with disabilities" (Scherrer, 2005, p. 133).

Super-users: Super-users are a group of teachers who consistently demonstrate a proactive and enthusiastic approach to integrating technology into their teaching and learning practices.

2.3 Understanding and researching digital technology integration for enhanced inclusion

The integration of digital tools in the classroom has the potential to enhance educational outcomes,

yet it also presents challenges and disparities in implementation. This section will explore existing literature on the integration of digital technology in education, inclusive education, potential barriers and the relationship between digital technologies and inclusive education.

"As a teacher, every day you deal with changes brought about by technology" (De et al., 2024, p. 13). Technology changes the world in which we teach as well as the schools, eventually changing what we teach, the content, skills and ultimately the context (De et al., 2024). Schools in South Africa, and around the world, are based on traditions that have emerged over time using a worldview that has shifted significantly due to how we live today compared to the past (Wray et al., 2018). Technology is part of this shift as we have access to and use technology more and more in everyday life. For schools to remain relevant, there is a need to change and adapt to a changed society (Wray et al., 2018). This change relies on the teachers and their ability to change how they engage with the learners in their class. "Technology has the potential to transform the teaching and learning experience" (Afzal et al., 2023, p. 885).

2.3.1 Digital technology in education

ICT integration into education began in earnest in the 1970s (Ghavifekr & Rosdy, 2015). The world was changing with the introduction of computers, and schools needed to shift to ensure they were able to prepare learners for the world (Ghavifekr & Rosdy, 2015). ICT integration relies on the right technology being used to support and enhance teaching and learning. This is an ongoing process due to the changing nature of technology (Ghavifekr & Rosdy, 2015). Ghavifekr and Rosdy (2015) found that barriers to the use of ICT were confidence, competence and belief. Teachers who have access to ICT training and support are more likely to use them in their teaching and learning practices. Technology has the potential to enhance learning through a multi-modal approach to teaching and learning, but only if the right technologies are used (Scherer et al., 2019) and everyone is on board with the implementation of digital technologies (Timotheou et al., 2023). Digital technologies have the potential to foster inclusion by creating opportunities for a multi-modal approach to teaching. This enables learners to access content in ways that align with their individual learning preferences and engagement styles, while also providing them with the freedom to express themselves using mediums they find most comfortable. This will be discussed in further detail later on in the literature.

In the past 20 years, teachers have managed the rise of smartboards, one device per learner, 'freemium' apps and virtual reality (Klopfer et al., 2024). Many of these technologies did not live up to the wide scale 'disruptive' promises and education practitioners learned that simply implementing technology does not guarantee better learning outcomes (Klopfer et al., 2024). In the 2023 EduCause Report, the authors state that teachers should use digital technology to improve teaching and learning (Pelletier et al., 2023). These tools should free up time for teachers to engage directly with learners and move away from the view that one tool or technique will suit all learners (Pelletier et al., 2023). One digital technology that has purported to free up teachers' time is Generative AI. Teachers have a large amount of administrative work, meetings and extra-curricular duties that decrease the time they spend in planning (Furze, 2024). Using Generative AI to support in lesson planning, the creation of resources and development of curriculums is a useful way to enhance the teacher's own expertise and professionalism (Furze, 2024). Generative Artificial Intelligence (GAI) uses prompts, or instructions, and creates new content in the form of text, images or audio (Klopfer et al., 2024). This 'new' content is generated based on algorithms working in vast datasets, that results in the new text, images or audio

based on features found in the dataset (Klopfer et al., 2024).

ICT integration relies on schools having the correct infrastructure and facilities such as devices and internet. Schools that do not have the ICT infrastructure and facilities are not able to integrate ICT into their teaching and learning (Ghavifekr & Rosdy, 2015). Along with the infrastructure, teachers need to feel confident using the ICT in their classrooms – training for pre-service and in-service teachers is essential (Ghavifekr & Rosdy, 2015). According to De, Higuera and Iyer (2024), schools need to watch out for two extremes in digital technologies: (1) under-utilisation due to fear and ignorance, and (2) indiscriminate use that might lead to undesirable secondary effects. Digital technologies have the potential to help learners acquire and practice new skills (De et al., 2024) but they also have the potential to widen the current societal divide (Klopfer et al., 2024). To date, the digitisation of education has been driven by private companies in the Global North, this needs to change to include alternative methods of inclusion in an increasingly globally interconnected system (Peruzzo & Allan, 2022).

For digital technologies to successfully create inclusive learning environments, there needs to be seamless integration in how they are used to help all learners engage with the content. Teachers need to be aware of their learners' context, culture and abilities and match these to the tools they use to achieve the learning objectives for their subject. Peruzzo and Allan (2022) identified five key concepts for fostering inclusive digital education. The first is accessibility, which involves removing physical barriers and using a multi-modal approach to engage all senses while allowing learners to lead content delivery with digital tools (Scherer et al., 2019). The second is affectivity, emphasising the need for personal connections between teachers and learners to enhance the impact of digital tools. The third concept, presentness, highlights the importance of linking the curriculum to local, societal, and global contexts to make learning relevant (Salas-Pilco et al., 2022). Interdependency, the fourth concept, stresses cross-border collaboration among schools and teachers to create authentic and socially just learning experiences. Finally, relatedness underscores the need for digital tools to be localised and contextually relevant, ensuring that content delivery aligns with the community's unique historical and cultural context (Peruzzo & Allan, 2022; Salas-Pilco et al., 2022).

Salas-Pilco et al. (2022) speak to the importance of the digital technologies used being culturally contextualised. This means the learning environments' social and cultural context must be considered. Culture influences what people learn, as well as how people learn (Salas-Pilco et al., 2022). Understanding the context in which the technology is used is critical, as this context either encourages or discourages the individual (Scherrer, 2005); and then developing a culturally responsive pedagogy enabled by emerging technologies creates the opportunity to innovate the learning process (Salas-Pilco et al., 2022).

School management and culture plays a vital role in the integration of technology as they both influence the teachers' attitudes (Ghavifekr & Rosdy, 2015). Teachers need to feel that innovation and development are valued by management and that they are supported through a culture of change acceptance or readiness (Ghavifekr & Rosdy, 2015). Teachers' professional development in schools, therefore, needs to have both a technological and pedagogical approach. In a study of Malaysian schools, it was found that even though the government upgraded schools with the infrastructure and facilities, the integration of technology was hampered due to the beliefs and attitudes of the teachers based on the school management and culture (Ghavifekr & Rosdy, 2015). For ICT integration to be

successful, school management needs to ensure that both teachers and learners are ready by providing training and support to create the right culture (Ghavifekr & Rosdy, 2015). To integrate technology successfully, schools need to change their culture, organisation, technology and operating models (Timotheou et al., 2023). Teachers need to create an environment where learners feel safe to be themselves (Wray et al., 2018) and develop the digital competencies required (Timotheou et al., 2023). This requires a safe environment for experimenting and learning, where people can show up authentically. "Without safety there is nothing, there is no learning" for either the learner or the teacher (Wray et al., 2018, p56). To create this culture in a school, teachers and management must reflect on who they are as role models and how they see others (Wray et al., 2018). Schools should reflect the social and cultural contexts in which they operate. Teachers need to be equipped to incorporate a culturally responsive pedagogy (Salas-Pilco et al., 2022) where teachers can begin to undo some of what our history has left us (Wray et al., 2018). This is only possible though, if teachers believe it matters and that they have the agency to change current systems, policies, and behaviour (Wray et al., 2018).

Timotheou et al. (2023) speaks to the multifaceted impact of technology integration in schools. His findings show an impact in (1) learners' knowledge, skills and attitudes; (2) equality, inclusion and social integration; (3) teacher's professional development and practices; and (4) the broader school functions and stakeholders (Timotheou et al., 2023). Exploring the impact on learners' knowledge, skills and attitudes, Timotheou found that the integration of technologies had a positive impact when used in conjunction with existing practices to supplement and support learning (Timotheou et al., 2023). As far as the impact on teaching practices, the impact was found to be greatest in supporting teacher planning and collaboration as well as when used to review learner submissions allowing for immediate feedback and teacher adjustments (Timotheou et al., 2023) such as Generative Artificial Intelligence. Generative Artificial Intelligence is different from other digital technologies as it is an arrival technology, this means it is not the result of educational policy adoption (Klopfer et al., 2024). All arrival technologies can cause harm in the school environment if they are not managed and integrated effectively by the teachers and the school (Klopfer et al., 2024). Learners need teachers to guide, support, help, share content and give feedback so they can be the creators not only the consumers of technology especially as it evolves (Klopfer et al., 2024).

Technology is changing very rapidly and is increasingly allowing teachers to co-create, collect, store and use knowledge and information within their school, immediate community and globally (Scherer et al., 2019). Education has a dual role of ensuring knowledge continuity and fostering creativity and change (Scherer et al., 2019). Thus, teachers need to continuously innovate and improve their teaching pedagogies. Digital technology is part of everyday life and teachers are increasingly being asked to integrate technology into their teaching and learning practices to ensure learners become digitally literate (Scherer et al., 2019).

For teachers to shift their teaching practices they need confidence in the new tools, change agility and the agency to choose what tools they use (Timotheou et al., 2023). The uptake and success of digital technologies depends on various factors, namely the teachers' personal characteristics or bias and digital competence, as well as the school leadership and management, socioeconomic context and infrastructure (Timotheou et al., 2023). Teachers need to be motivated to embrace the digital technologies available. Scherer, et al (2019), found that teachers' motivation is impacted by how much they believe the use of technology will free them from effort in developing and delivering learning

opportunities as well as the perceived usefulness of technology and their personal attitudes towards digital technology.

2.3.2 Inclusive education in schools

During the pandemic, digital education was rolled out across the world to promote continuous learning and prevent learning loss (Peruzzo & Allan, 2022). The result was increased exclusion and the development of new vulnerabilities due to the digital divide, where children, ethnic minorities, indigenous people and special needs learners were most affected (Peruzzo & Allan, 2022). The digital divide is used to describe the inequalities in the use of digital technologies and is "increasingly used to explain the social implications of imbalanced access" (Afzal et al., 2023, p. 884). To counter this, teachers and learners need to be equipped with skills, both digital and non-digital, to counter exclusion in all forms. This is an ongoing process, as digital integration is complex and developed continuously (Timotheou et al., 2023). Different technologies open up different opportunities for learners, teachers and schools to improve and innovate (Timotheou et al., 2023). Although digital technologies are in use in our everyday lives, there is a big difference between using technology for personal use and employing them in formal education (Panesi et al., 2020). Teachers need to be informed about the most effective ways to integrate digital technologies into their teaching practices, which can lead to improved learner engagement, collaboration and personalisation of their learning experience (Afzal et al., 2023).

To achieve inclusion, teachers must be equipped with the right skills and knowledge to create multi-level classroom instruction, cooperative learning, problem-solving, and to develop individual learners' strengths (Department of Education, 2001). This requires teachers to have the knowledge, skills and values to help learners build from where they are (Christiansen & Bertram, 2019). Christiansen and Bertram (2019) found that many practising teachers do not understand the actual content they are teaching and therefore have not explored what could be causing barriers to learning. To equip teachers with the skill to create inclusive environments, professional development should focus on understanding content and how to teach it; and challenging traditional educational thinking and practices, including exposure to learners with barriers to learning (Krischler & Pit-ten Cate, 2019). "What is taught in class, the curriculum, is not created by the young people in schools, but by the adults and it is there that the transformation needs to begin." (Wray et al., 2018, pg. 65). Children should not need to 'fit in' to existing structures when there can be a plurality in pedagogy and curricula, and technology can be leveraged to enable and support all learners (Peruzzo & Allan, 2022).

2.3.3 Technology that enables inclusion

When reviewing the training that teachers receive, one also needs to look at the tools available to teachers, specifically when it comes to learners with learning difficulties. If teachers are not exposed to learners who face challenges, how can they be equipped to create inclusive environments? According to the Education White Paper 6, teachers should be equipped to provide various levels and kinds of support, including necessary assistive technologies (Department of Education, 2001). Assistive technologies are used explicitly with learners with a cognitive learning barrier to enable learning (Perelmutter et al., 2017). Assistive technologies can be effective if customised to the learner, but many learners have highlighted that they do not receive enough support from teachers when using these

tools (Perelmutter et al., 2017). Assistive technologies fall under the broader digital technologies umbrella as they are digital tools used to create an inclusive learning environment focusing on specific learning difficulties. Teachers need an education and training system that accommodates learners who face difficulties (Department of Education, 2001). Research has shown that all learners benefit from inclusive education, but many teachers have not accepted the concept of inclusion, nor do they implement inclusive practices (Krischler & Pit-ten Cate, 2019). Attitudes towards learners with learning difficulties vary based on the challenges faced, and learners with physical or learning difficulties are often seen more positively than learners with intellectual or behavioural challenges (Krischler & Pit-ten Cate, 2019).

2.4 Barriers to digital technology integration

The barriers to digital technology integration in education can be attributed to several factors. Teacher beliefs and attitudes often lead to resistance, as many teachers fear appearing incompetent when using new technologies, particularly if they lack self-confidence or experience. Inadequate training and professional development further hinder teachers' competence and confidence in using digital tools effectively. Additionally, insufficient access to resources, such as outdated technological infrastructure and inequitable access to devices, restrict the successful integration of digital technologies. Institutional challenges, such as unclear expectations and limited support from leadership, contribute to the inconsistency of technology use across classrooms. Personal constraints, like time and lack of collaboration, also play a significant role, leaving teachers isolated in their efforts to integrate technology. Moreover, the mismatch between available tools and the curriculum's specific needs, particularly for marginalised learners, exacerbates these issues.

This section will explore different barriers to creating inclusive learning environments as well as to the integration of digital technologies in the classroom.

2.4.1 Bias as a barrier

The barriers mentioned above are closely linked to various forms of bias, both in technology design and in teacher practices. Bias in teacher practices is a third-order barrier that can manifest as resistance to new tools, driven by self-doubt or preference for traditional methods. Teachers may also unconsciously favour technologies that align with their existing knowledge or comfort level, overlooking tools that might better support inclusive learning. Bias in technology design can result in digital tools that are not accessible or inclusive, particularly for learners with disabilities or those from marginalised backgrounds. Furthermore, institutional biases may arise when policies or resources fail to adequately support diverse learners or ensure equitable access to digital technologies. These biases can perpetuate inequities in the classroom, making it essential to address them to create a more inclusive educational environment. The following discussion will explore how these biases influence the effective use of digital technologies and the need for more inclusive, equitable solutions.

Teachers' attitudes and beliefs play a major role in how they show up in the classroom and engage with their learners. These attitudes are formed by implicit biases which are mental associations that affect the way we behave in an unconscious manner (Gonzalez et al., 2021). Unconscious bias is a human condition that can be overcome if we learn to recognise and mitigate it (Emberton, 2021). Teachers need to recognise when they are biased towards learners in their classroom and mitigate the impact that has on the decisions they make.

2.4.1.1 Implicit bias

Implicit bias is the "attitudes or stereotypes that affect our understanding, actions and decisions in an unconscious manner" (Staats, 2015, p. 29). They are our beliefs. Bias is an evolutionary process that allows us to use prior knowledge and experiences to inform how we behave (Cikara & Van Bavel, 2014). In 2011 Daniel Kahneman discovered two systems in the brain that work together to help us make sense of the world: system 1 functions outside of conscious awareness to automate decisions, actions and understanding; system 2 is the conscious processing of information that requires effort and deliberate concentration (Staats, 2015).

Although bias has served humans well in the past, not all biases serve us in our current world. At a cognitive level, bias has us believe that people like me are better than people who aren't (Cikara & Van Bavel, 2014). Bias allows us to judge people based on characteristics that do not matter, allowing in-groups and out-groups to form (Wray et al., 2018). In-groups and out-groups form in all levels of society and can be based on something as simple as a group wearing a red shirt, versus others wearing blue shirts (Ross, 2008). If we judge people based on something as simple as a t-shirt, then teachers can similarly judge learners based on preconceived beliefs about their behaviour, background or past performance. Although we humans have biased brains, we also have the capacity to nudge ourselves towards more rational thinking (Smith, 2018). To do this, we need to acknowledge we have bias and then work at identifying and shifting our unconscious bias (Smith & Rock, 2018).

"More times than not, people make choices that discriminate against one group in favour of another, without even realising that they are doing it, and perhaps even more strikingly, against their own conscious belief that they are being unbiased in their decision-making" (Ross, 2008, p. 2). Bias helps people to automate their decision-making based on what or who is safe using their unconscious (Smith & Rock, 2018). These unconscious decisions can be corrected by our conscious if we notice the decision we have made (Ross, 2008). For teachers who need to make quick decisions based on what is taking place in their class, this unconscious decision-making tool can help them, but only if it isn't detrimental to a particular group of learners in their class. "Scientists estimate we are exposed to as many as 11 million pieces of information at any one time, but our brains can only functionally deal with about 40" (Ross, 2008, p. 5). The biases we have developed over many years becomes one of the lenses that filter this information for us. Decisions based around people become hardwired so that we can quickly decide if someone or something is safe based on whether they feel safe, likable, valuable or competent (Ross, 2008). What feels good to us is based on what we value, causing us to classify people into in-groups (like us) and out-groups (not like us) (Ross, 2008). "All of us have some groups with which we consciously feel uncomfortable, even as we castigate others for feeling uncomfortable with our own groups" (Ross, 2008, p. 6). This plays out in schools where teachers don't feel comfortable around learners who are different to them, cognitively, socially or otherwise.

Working in South African schools poses challenges for inclusion due to the diverse nature of the learners. Since South Africa became a democracy, there has been a mandate for schools to become inclusive environments, but this has been a slow process. Teachers need to want to change their behaviour and not just be made aware of potential bias (Wray et al., 2018). We make assumptions and determinations about what is in front of us every day, deciding what's real or not, based on our perceptions. This decision making is so hardwired into us that awareness of our bias alone isn't enough to change how we respond and behave (Ross, 2008). Teachers need to actively be aware of their bias and attitude, and make a conscious decision to change their attitude and then behaviour.

2.4.1.2 Bias in education

Implicit bias can result in barriers to learning for learners who fall into the out-group, as well as causing barriers to technology for teachers and learners depending on their personal biases (Staats, 2015). Our bias influences our behaviours and our decision-making process if we perceive learners as not being capable of achieving a task or undertaking a particular piece of work based on our perception of them; our unconscious bias may get in the way of their learning (Emberton, 2021). The same can be said for the use of digital technologies in education, we may choose not to use them as we have decided they are inherently bad for learning, or we can teach better without them, or the learners we teach won't engage in the content due to the technology – these perceptions can prevent us from even trying to use technology (Staats, 2015). Shifting teachers' approach to technology requires behaviour change, not merely awareness of the technology (Smith & Rock, 2018).

Researchers have found that when there is incomplete information, or the situation is ambiguous, we will default to a system 1 (unconscious) response (Staats, 2015). In a classroom, there is often incomplete information and ambiguous situations, so teachers are at risk of relying on their unconscious more often. Especially when there is a time constraint and cognitively the individual is struggling due to overload, which is normal for teachers (Staats, 2015). Teachers are often called on to make decisions regarding the way forward for a learner in a short time frame, with limited information. Teachers therefore default to what they believe – their bias – to make decisions (Allen & Garg, 2016). These decisions reinforce existing attitudes and behaviours. To help our brains cope with the large volume of data we are exposed to, we use shortcuts and stereotypes to help us. One bias that is prevalent in education is confirmation bias, where we see what we expect to see (Staats, 2015). For example, if we are marking a learner's assessment and we expect them to do well, we will automatically see fewer errors, but if we expect them to have made mistakes, we see more errors (Staats, 2015).

2.4.1.3 Mitigating bias

It is good to know that the brain is malleable (Staats, 2015), which means we can change and shape our thinking and behaviours. Over time and with repetition, we can inhibit our implicit bias (Staats, 2015). To do this, we first need to be aware of what our biases are and then consciously work to inhibit them. When engaging with different groups of learners, teachers need to meaningfully engage with those groups or individuals whose identities differ from our own (Staats, 2015). According

to Jay Van Bavel in Rock (2009) “increasing a group’s sense of common identity leads to greater cooperation, coordination, and collective intelligence” (Rock, 2009). This sense of common identity can only be achieved if we work to break down the invisible divides created in our unconscious in- and out- grouping. In schools, this would mean reviewing policies that govern how the school functions, to ensure they are flexible and inclusive of the diverse learner body in South Africa (Wray et al., 2018). Schools should also expose teachers and learners to counter-stereotype exemplars (Staats, 2015). For example, if the school has a teacher body refusing to use technology as they feel they are too old, find older teachers who use technology to come and speak to them. Another example could be in an all-girls school where learners are choosing not to take science as a subject. That school could highlight successful female scientists using posters, stories and photos in school communications. Schools also need to take a more data-driven approach to mitigating bias and creating inclusive spaces. Gather data to understand the trends in your school, pause, and then engage with the full school community to mitigate existing bias (Staats, 2015).

2.4.2 Implicit and explicit barriers to digital technology integration

As discussed previously, implicit bias refers to the unconscious attitudes or stereotypes that influence our decisions and actions, while explicit bias involves conscious beliefs or attitudes that we are aware of and may openly express. Teachers deal with changes brought about by technology everyday (De et al., 2024). Their bias determines how they engage with these changes in technology. Teachers require not only content knowledge but also pedagogical and technological knowledge (TPACK) to effectively integrate technology into their teaching (Tsai & Chai, 2012). Implicit and explicit biases towards technology can limit their ability to fully harness its pedagogical potential, as teachers may either unconsciously resist new tools or consciously dismiss them, hindering the enhancement of both pedagogy and content through technology (Kim et al., 2013).

In some cases, knowing how to use technology in relation to your content is enough for integration but not always. There are three orders of barriers that can prevent integration. Ertmer defined the first and second order barriers (Ertmer, 1999), and Tsai and Chai introduced the third order barriers in 2012 (Tsai & Chai, 2012).

2.4.2.1 First order barriers

First order barriers are external and relate to the environment in which a teacher teaches (Ertmer, 1999). These barriers refer to the access or lack of access teachers have to technology, the time they have to learn the tools, the training they can attend, and the support their institution will provide them with (Tsai & Chai, 2012). First order barriers are normally easier to resolve as they relate to physical, tangible items.

2.4.2.2 Second order barriers

Second order barriers are intrinsic (Tsai & Chai, 2012). These are the teachers’ personal beliefs regarding pedagogy, technology and their willingness to change (Ertmer, 1999). Second order barriers are much more difficult to resolve as they are internal to the individual (Johnson & Tawfik, 2022).

These barriers can be intertwined with first order barriers. For example, the lack of access to technology may result in the belief that it will not work in your context (Johnson & Tawfik, 2022).

2.4.2.3 Third order barriers

Tsai and Chai (2012) argue that first and second order barriers can be resolved if teachers have stronger technical, pedagogical and content knowledge (TPACK) (Tsai & Chai, 2012). In their view, TPACK allows for the dynamic creation of knowledge when confronted with advances in technology. They view the inability of teachers to apply TPACK as a third order barrier – the lack of design thinking (Tsai & Chai, 2012). This is the ability to change and improve your current situation to create what is desired (Tsai & Chai, 2012). Classrooms are dynamic spaces and technology integration is not always smooth; this is where the capacity to think creatively and solve any issues that arise becomes vital in integrating technology. "Barriers always exist in one form or another and design capacity is usually sharpened in a constrained environment" (Tsai & Chai, 2012, p. 1059).

Equipping teachers with knowledge on digital technologies to ensure they can adapt to the changing digital space, as well as how these technologies can be used in the classroom with their content, will allow for better integration and resolve potential barriers.

2.5 Critique of literature

The literature review provides a thorough exploration of the challenges and considerations associated with equipping teachers for inclusive education. However, a notable gap emerges regarding how training and teacher agency influence the integration of digital technologies. Much of the cited literature centres on the South African context, primarily from a policy perspective, which may restrict the applicability of its findings to other educational settings. This highlights the need for further research that considers both the broader international context, and the specific, nuanced challenges faced by schools within South Africa.

Additionally, while the review emphasises the importance of training and equipping teachers with the necessary skills and knowledge, it does not delve into the practical challenges and potential limitations of implementing extensive teacher training programmes (Kimathi & Rusznyak, 2018). Questions about the feasibility of providing 80 hours of in-service training annually to teachers, especially in resource-constrained settings, should be addressed (Department of Education, 2001). Moreover, the review does not explore all barriers to adopting digital technologies, which are essential for creating inclusive learning environments. Exploring the first order barriers, such as limited access to technology or training in its use, could provide a more holistic perspective on educators' challenges in South Africa (Perelmutter et al., 2017). The review mentions the importance of customised technologies but does not delve into the complexities of tailoring these technologies to the unique needs and preferences of individual learners. The practical implementation of such customisation, the cost implications, and the need for ongoing support are important aspects that merit consideration. One also needs to consider the agency of the teacher and learner when understanding the adoption of a new methodology or practice, for example digital technologies (Archer & Morgan, 2020). The research into teachers' beliefs is limited, and more is needed to fully understand teacher beliefs around the nature of

knowledge and learning, as well as beliefs around effective teaching practices using technology (Kim et al., 2013).

While the literature review provides valuable insights into the importance of teacher training and educational technologies for inclusive education, it is crucial to acknowledge the need for a more nuanced exploration of the practical challenges and potential limitations associated with these approaches.

2.6 Investigating digital technology integration and inclusive education

Social realism (SR) will be used as the theoretical lens to explain the relationship between the school context and the teachers, and how this influences the use of digital technology for inclusive education (Archer 2000, 2003). This sociological theory focuses on "looking for explanations (causal mechanisms) through a focus on what people can achieve (agency) in the social context in which they are operating (structures)" (Stutchbury, 2022, p. 114). Using this framework and drawing on the literature reviewed, it can be inferred that the structure of teacher training and development may contribute to the observed outcome, where teachers are unprepared to implement inclusive practices. This study will look at how the structures in place influence how inclusion and technology are viewed, and how they interact. It will also explore whether institutional culture influences the existing structures and how and whether it mediates the actions of teachers. Finally, it will explore how the agency of the teachers affects the creation of inclusive learning environments and the use of digital technologies.

2.6.1 Critical realism and social realism

Bhaskar (Lawani, 2020) formulated critical realism during the 1970s–1980s as a philosophical framework aimed at comprehending how subjective insights of social actors within a specific context interact with the autonomous structures that both encompass and enable these actors to engage with activities within that context. Critical realism is an all-inclusive philosophy measuring the underlying causal relationships between social events (Lawani, 2020). Margaret Archer (Archer & Morgan, 2020) utilised critical realism to bolster her notion of social realism, developing analytical tools to comprehend the dynamic interaction between structure and agency. Archer brought the social into realism to explain the importance of individual reflexivity and agency in taking societal action (Cox, 2016). Critical realists describe the complexity of social reality, as comprising dimensions such as culture, structure and agency (Cox, 2016). It would be inadequate to focus on one element without considering the other two. It is therefore essential to acknowledge the timeline within which culture, structure, and agency evolve, interconnect, and reshape each other, illustrating the dynamic nature of these components as they mutually influence one another over time (Archer, 2000). Archer shows that "structure" and "agency" are different kinds of emergent entities "despite the fact that they are crucial for each other's formation, continuation and development" (Archer & Morgan, 2020, p. 184). From this, Archer (2020) shows that an educational system can be centralised whilst a person cannot be, because humans can reflect on their actions while organisations cannot (Archer & Morgan, 2020). "Bodies have properties and powers of their own and are active in their environment, which is broader

than 'society's conversation'" (Archer, 2000, p. 4). Reflecting upon our way of being helps us to inform and create our personal identity, which is not made under circumstances of our own choosing but through our engagement with the structure and culture of the environment (Archer, 2000).

For this research, it can be interpreted that different teachers will experience and apply the curriculum differently based on their own experiences and environments. So, they may all have the same starting point (the curriculum) but apply different pedagogies in their classrooms. Social realism looks for the causal mechanisms – the why – by focusing on what people are doing, their agency (within their specific contexts), and the structure. It requires individuals to reflect on their social context and individual practices. These reflections are subjective, revisable and uncertain, making them fallible (Cox, 2016). Archer (2020) asserts that it is important to ask whose actions are responsible in a change, through which interactions, when and where and with what consequences, to determine how the change took place and the impact of the change (Archer & Morgan, 2020). This research will examine how teacher agency influences the integration of digital technology within the school environment, focusing on the interplay between the structure and culture of the school, and the training and development teachers have received. By investigating the practical implementation of the Department of Education's inclusive education policies, the study will explore the social and organisational factors that shape teachers' use of digital technologies. It aims to uncover the underlying practices driving observable practices and outcomes in inclusive education (Lawani, 2020). It is important to note that teachers play a pivotal role in determining how digital technologies are implemented, and social realism allows us to look at how people act within the structural and cultural circumstances based on their own agency (Cox, 2020).

If we use the analogy of an iceberg, the empirical level from critical realism is the top of the iceberg that is visible and known, while the actual level – just below the surface of the water – is the objects or events that occur in the world. Lastly, the real level is the bottom of the iceberg, the deeper-lying structures and causal mechanisms as played out in society (Stutchbury, 2022). This is important for this study, as it will explore how in-service teachers are prepared for the real world of teaching, where they are required to meet particular expectations. They interact with the structures of the school they teach in, as well as the culture of the school and the broader community. Teachers need to make decisions on how best to meet the learning objectives of their subject and need to exercise their agency to achieve this.

2.6.2 Morphostatic/morphogenetic (M/M) approach as a framework

The researcher referred to the M/M approach for this study to iteratively explore how exposure to digital technologies and inclusive practices shift in-service teachers' practices over time. Working collaboratively with in-service teachers to understand the extent of the change and how it is experienced through the lens of social realism equipped the researcher to create an intervention that addresses the actual need. M/M is a workable methodology, as structure and agency operate diachronically over different time periods due to the fact "that structure pre-dates the action(s) that transform it and structural elaboration necessarily post-dates those actions" (Archer & Morgan, 2020, p. 184). Archer (2020) asserts that M/M is temporal due to the flow of time from the past to the present, which is vital to consider when breaking down the social interactions for analysis (Archer & Morgan, 2020).

To fully understand the current context, we need to explore the history of the structure, to explain where it comes from due to its development over time (Archer & Morgan, 2020).

Archer (2020) visualises the M/M process as follows:

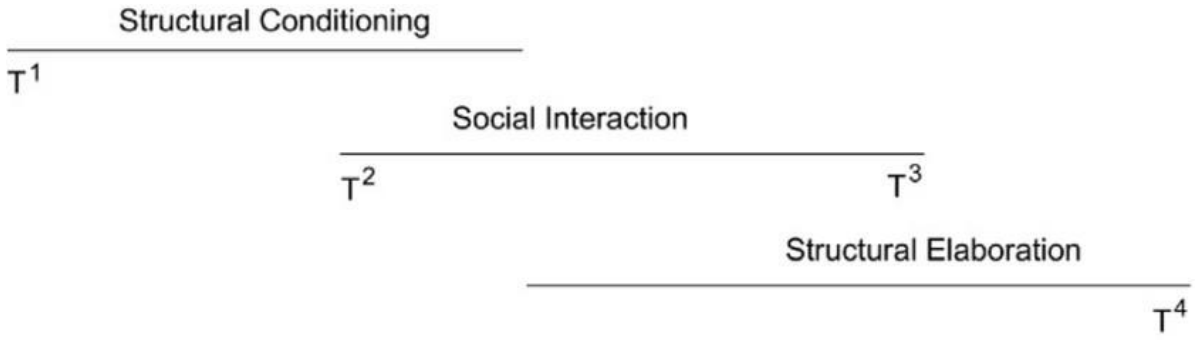

Figure 2: The basic morphogenetic diagram (Archer & Morgan, 2020)

Archer (2020) maintains that the social contextualisation of the interaction initiated at T^2 needs to be explained through returning to the state of affairs at T^1 (Archer & Morgan, 2020). Going backwards allows the researcher to understand what was wanted, or not wanted, that motivated the agent to engage in the interaction (Archer & Morgan, 2020). Without understanding the previous context, we cannot know why the interaction occurred in the manner it did. According to Archer "every current emergent structural property has a history"; giving a full and accurate account of that history allows us to explain how it developed over time and not simply how it works at that specific time (Archer & Morgan, 2020, p 185). Structure, culture and agents all possess powers that are exerted on each other. To study a social change is to look at how structural and cultural powers impose themselves on agents and how the agents use their personal power to choose how they act in each situation (Archer, 2003). The structural and cultural powers can become enablers or constraints for the agents, and shape the outcome based on how they constrain or enable the agent's ability to act (Archer, 2003). Using the M/M approach allows the researcher to explore the teaching and learning context prior to digital technologies being introduced into school environments, as well as the change in teaching and learning post the introduction of digital technologies. The researcher will be able to explore any structural and cultural changes, as well as the agency of teachers, in deploying education technology in their classrooms – and the impact thereof. Structure, culture and agency are interrelated and need to be analysed in each cycle (Archer & Morgan, 2020) to determine the potential constraint or enablement of the structural and cultural contexts (Archer, 2003).

As the interaction (T2) between teachers and digital technologies unfolds, it leads to structural elaboration (T3). This captures the outcome of teachers' responses to the new structure (the introduction of digital tools in classrooms) and how these responses either reinforce or alter the existing educational structures (Archer, 2003). In the case of this study, the introduction of digital technologies potentially modifies classroom practices, teaching methods and student engagement. Teachers, as agents, influence the adoption of these tools by adjusting their pedagogical approaches to incorporate the new technologies or not (Archer, 2003). This iterative process of change allows for the evolution of teaching methods and curriculum delivery, which might either reinforce existing practices or lead to the development of new structures that better support inclusive education (Archer & Morgan, 2020). The results from this phase reveal how structures evolve as teachers engage with the new technologies, and the ways in which the wider educational system may begin to reflect these

shifts in practices.

Following the structural elaborations of T3, T4 focuses on the new conditions that arise as a result of the interactions and transformations that have occurred (Archer & Morgan, 2020). This phase explores how the changes introduced by the integration of digital technologies shape future practices, policies and teacher actions. The transformed structure becomes a new context that agents (teachers) and culture (educational norms and values) must operate within (Archer & Morgan, 2020). The feedback loop created in T3, where agents adjust and shape structures, now leads to a new set of structural conditions. These conditions, in turn, influence the future behaviours of teachers, who are now conditioned by the changes they have helped bring about (Archer & Morgan, 2020). Teachers' increasing confidence and capability with digital tools may lead to new expectations and requirements within the school system, which could be institutionalised in future professional development plans, curriculum updates, or teaching strategies. As T4 unfolds, these new structures begin to influence the broader educational landscape, with the potential to shape the development of inclusive education further, based on the success or challenges of previous interactions (Archer & Morgan, 2020).

2.6.3 Teacher development and digital technologies

Teacher development should equip teachers with the "knowledge, skills and values to help learners build from where they are" (Christiansen & Bertram, 2019, p. 79). This study will explore how the school's organisational context impacts the teacher's ability to help learners build from where they are. Teachers should be developed to challenge traditional educational thinking, practices and contexts (Krischler & Pit-ten Cate, 2019) to create equitable and inclusive environments through teacher-learner interventions. Research shows that teacher interventions are more successful when teachers are involved and when they leverage local knowledge and agency (Christiansen & Bertram, 2019). The study will also explore the teacher's professional agency to create these interventions using digital technologies if applicable. These interventions are most effective when the solution is co-created by the learner and teacher, requiring the teacher to be equipped with the knowledge and skills to use the different digital technologies available (Scherrer, 2005).

When reviewing the professional development offered by the South African Council for Educators (SACE), the Independent Exam Board (IEB) and Cape Teaching and Leadership Institute (CTLI), one can determine that CTLI offers a range of professional development options covering curriculum improvement, phases specific development, ICT integration, leadership development, library studies and teaching qualification improvement (Western Cape Education Department, n.d.). Focusing on the ICT integration, in-service teachers have the opportunity to attend online or face-to-face sessions that cover a wide range of topics, from digital storytelling to technology in the classroom, including AI. These courses are offered to all teachers in the Western Cape and are either free or have a nominal cost (to cover catering). The curriculum improvement courses cover different aspects of the subject curriculums in detail, including how to address learning barriers and profound intellectual disabilities. As the professional council for teachers, SACE aims to improve the status of the teaching profession mainly through the registration of teachers, enforcing a common code of conduct, and managing the professional development available to educators (*SACE*, n.d.). In this regard, SACE does not offer professional development directly to teachers but works with providers to ensure the needs of teachers are being met with regard to professional development.

2.6.4 How social constraints influence digitally enabled inclusive education

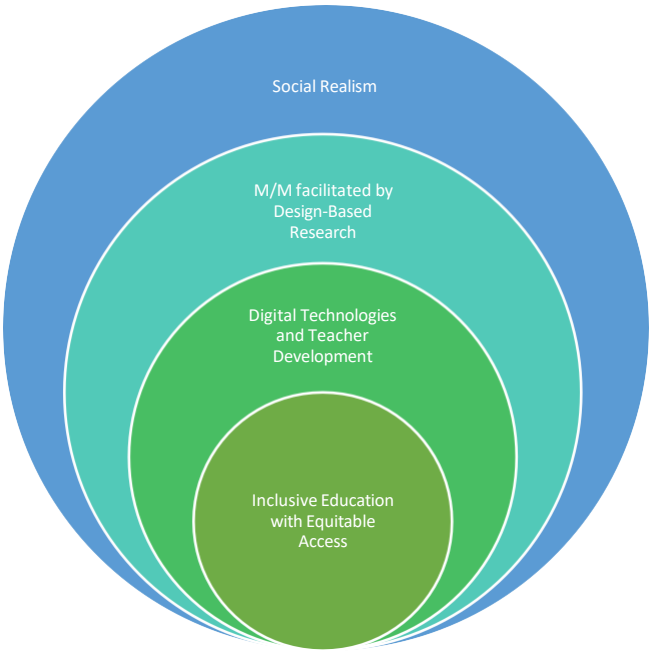

Figure 3: Integrating the research within the theoretical context

Teachers in South Africa are expected to provide a learning environment that caters to learners with different learning needs through various levels and kinds of support (Department of Education, 2001). This research will explore how in-service teachers are equipped both within the schools they teach, and through external offerings, to provide an equitable learning environment through their knowledge of inclusive learning practices and the use of digital technologies. It is important to explore how we move to inclusive education in this research (Figure 3). Soda (2022) states that as a society, we are moving away from the idea and importance of "equality" and replacing it with the idea of "equity". This implies a shift from the concept of uniformity to that of impartiality, as uniformity becomes obsolete in a world marked by individual differences. Quality education seeks equitable solutions and universal access to education, as education enables upward socioeconomic mobility and aids global and local development (Soda, 2022). To truly deliver inclusive education, we need to understand the society (the structures, culture and agency) within which the education is delivered. M/M (Archer & Morgan, 2020) allows the research to explore how the educational landscape has changed due to the use of digital technologies within the social realism theoretical framework using a Design-based research approach.

2.7 Conclusion

This chapter examined the existing body of literature relevant to the integration of educational technology in creating inclusive learning environments. It has explored key themes including digital inclusion, teacher's digital competence, pedagogical models for technology integration, and the barriers and enablers of effective practice. The review has also highlighted the role of teacher agency, institutional structures, and student diversity in shaping the effectiveness of digital technologies in educational settings. Despite a growing recognition of the potential for technology to foster inclusivity, the literature reveals a gap in understanding how teacher practices and professional development strategies can support sustained and meaningful integration. The next chapter will review the methodology used in gathering and analysing the data for this study.

Chapter 3: Methodology

3.1 Introduction

The focus of this study is to understand the impact of digital technologies in creating inclusive classrooms. Social realism has been used to analyse the context (structure and culture) of the teachers who have been surveyed and interviewed. Social realism allows researchers to explore the social structures constructed by individuals with the knowledge that there will be things we know about and things we do not know about, but which research can expose (Stutchbury, 2022). This research aims to understand the relationship between structure and agency in relation to inclusive education and digital technology in the intransitive domain. In addition, a design-based research approach included a training intervention in the form of a workshop, and then subsequent interviews. This chapter includes a description of the choice of methods, how participants were selected, and how the data was analysed. This chapter also includes the description of validity and ethical concerns.

3.2 Mixed methods

This study explored the teachers' attitudes towards, and perception of, inclusive principles and practices. Alongside this exploration, in-service teachers' digital literacy, attitudes towards technology and experience with digital technology were investigated. As these are social constructs, social realism was applied as an overarching theory to understand the relationship between inclusion in schools and digital technologies.

The intervention took the form of an initial survey designed to address the research areas required. The data from this was analysed to access gaps in knowledge of both inclusive education and use of technology. The survey was administered to all teachers in the selected school. After the survey, the senior-school teachers were selected for the intervention. The phased interventions took the form of in-person workshops, individual interviews and one-on-one support sessions. The in-person interventions equipped in-service teachers with the skills and knowledge to integrate digital technology into their classrooms to make them more inclusive spaces. The one-on-one interviews with selected subject heads and digital super-users, described below, determined the uptake of digital technologies in the classroom, and the perceived results for individual teachers and within departments.

3.3 Case study approach

The research for this study takes place at an all-girls, independent school in the Southern Suburbs of Cape Town. This school was selected as the researcher has access to the teachers in the school because the researcher is employed at the school. According to Yin (2013), case study research is best applied to studies that seek to explain how or why a social phenomenon works (Yin, 2013). In other words, qualitative case studies search for meaning and understanding (Merriam, 2009). Case studies focus on a particular situation or circumstance. The "case study method allows investigators to retain holistic and meaningful characteristics of real-life events" (Yin, 2013). Case studies allow the researcher to create a richly descriptive product based on the data they collect (Merriam, 2009).

According to Merriam (2009), a case study is a bounded system in that the researcher selects what will be studied to determine how the particular phenomenon or situation behaves in that instance. A case study does not require any particular methods for data collection; and as such, any and all methods of research from surveys to observation and interviews can be used (Merrian, 2009).

A case study approach assisted in exploring the role of digital technologies in creating an inclusive learning environment. Although there is a rich variety of research on digital technologies used in education, and what inclusive education is, there is little research on how digital technologies impact inclusion in South African schools. The researcher has chosen a single independent school to examine the experiences of senior-school teachers regarding the use and impact of technology in fostering an inclusive learning environment. In this case study, the researcher was interested in a more clearly delineated entity (Babbie & Mouton, 2002). This study fits Merrian's (2009) definition of a bounded system to study as a case study. There was a single phenomenon to focus on in this study, namely digital technologies. This study makes use of multiple sources of data, such as surveys, interviews and observations, as required for a case study (Babbie & Mouton, 2002). This allows for multiple perspectives to be discovered and interpreted. This replication of data increases the confidence the researcher can have in the data (Babbie & Mouton, 2002).

3.4 Selection of participants

3.4.1 Site selection

The study took place in an independent girls' high school in the Southern Suburbs of Cape Town. This site was chosen as the researcher is employed at the school and has access to the teachers for in-person sessions as well as interviews, observation and surveys. The school has both a senior and preparatory school. Although teachers from both sites were involved in the initial survey, the senior school was selected as the case study site for in-depth analysis. The researcher requested ethical clearance from the School of Education (see appendix) and then sought permission of the Deputy Head: Academics within the school.

3.4.2 Selection of participants

Sampling is the process of selecting who to observe, interview, workshop (Babbie & Mouton, 2002). The initial survey was distributed to all teachers across the preparatory and senior schools, adopting a census approach to gather comprehensive data on current educational technology practices. For the qualitative phase, selective sampling was employed to select senior-school teachers, and within that group, subject heads were chosen for interviewing, observing and workshopping. This decision was informed by the central role that subject leaders play in shaping departmental practice and driving inclusion initiatives through pedagogical leadership. The mixed-methods design enabled triangulation and enriched the analysis by capturing both the breadth and depth of practice (Babbie & Mouton, 2002). This sample was chosen due to the researcher's access to all senior-school teachers, and the senior school being used as the case study site.

When interviewing teachers, the subject heads were selected as the first group to be interviewed. This selection was made due to their seniority within the school. Of the 18 subject heads available, six consented to be interviewed. The subject heads interviewed headed up the following departments: Design, Physical Science, History, Research, Learning Support, and Mathematics. Based on the subject head data, as well as the initial survey data, the first senior-school teacher workshop intervention was facilitated by the researcher. All senior-school teachers were included in the workshop interventions. After the workshop interventions, eight super-users were identified based on their willingness to engage with and test different digital technologies. These super-users belonged to the following departments: History, Research, Afrikaans, Business Studies and English. The remaining departments were not included as super-users due to the teachers' current lack of technological integration. The final group of senior-school teachers who were surveyed was based on years of experience. Senior teachers, who were identified as teachers who have been teaching for 15 years or more, were surveyed to assess their experience of teaching with and without technology. Junior teachers, who were identified as teachers who have been teaching for less than 5 years, were surveyed to assess their experience of teaching with technology. The survey was sent to all senior-school teachers who had been teaching for 0 to 5 years, or for 15 years or more. A total of six senior-school teachers responded to this survey.

3.5 Data collection and management

This data management plan outlines how the data from the surveys, interviews, workshops and observations will be collected, stored, managed and used throughout the research process.

3.5.1 Data collection

All surveys were created in a locked Microsoft Forms account with limited access to the results. An email was sent to all teachers in both the preparatory and senior schools to explain the purpose of the survey, and to reiterate that participation was voluntary. The surveys made use of both closed and open-ended questions to capture quantitative and qualitative insights. The final survey of the experienced and inexperienced teachers was created in Microsoft Forms and emailed to all participants. Prior the administering the surveys, the questions were reviewed by the Deputy Head: Academics to ensure they were appropriate and clear. Microsoft Forms was selected as the tool due to the school's use of the Microsoft Education license, thus ensuring all teachers had access to the questionnaire.

There were two types of interviews. The first interview with the subject heads was structured and the second with the super-users was unstructured. These interviews took place face-to-face and audio recordings were made (with consent) and transcribed post the interview. Subject heads were contacted digitally and those who responded positively to the request to be interviewed were contacted via email to confirm a time and location to be interviewed. All participants were informed of the purpose of the interview and that they were participating voluntarily. Subject head interviews took place in the subject heads' classroom, or in a location of their choosing, with all interviews being recorded on the researcher's iPhone and transcribed post the interview. Prior to interviewing all subject heads, a pretest was performed with one subject head to improve question neutrality, avoid leading language and refine question phrasing. The "super-user" interviews were conducted in private spaces at school and recorded on the researcher's iPhone. Prior to interviewing all subject heads and super-users, a pretest was performed with one participant to ensure timing and comfort, as well as to

improve question neutrality and refine question phrasing.

Workshops were run with all senior-school teachers and in smaller staff development groups. Observations were noted manually and transcribed digitally post the workshops (Figure 4 and 5), so the data gathered during these workshops could be analysed for the study. Classroom observations were recorded in field notes, documenting the use of digital technologies and resulting learner behaviour. This data was integrated with the workshop and survey data to form a fuller picture of technology integration in the senior school.

ey Themes:		Comparison Based on Key Reflection T
Support and Resources:		**1. Structural Influences (Policies, Resources, In**
any responses highlight institutional support (e.g., SMART boards, oogle Classroom, iPads), mentioning how technological resources ıve made teaching easier or more interactive.		**Experienced Teacher**: The responses mention t technologies, like SMART boards, iPads, and pr easier. However, barriers like students not havi newer technology cause frustration.
		New Teacher: The new teacher also highlights projectors, but mentions limitations, such as o cameras), lack of knowledge on using advance and issues around device disparity among stuc
Evolving Teaching Methods:		
		2. Institutional Expectations:
achers mention adapting to new technologies like interactive oards, iPads, and educational apps, showing a trend of continuous arning and integration		

Figure 4: Photographic images of the "super-user" analysis

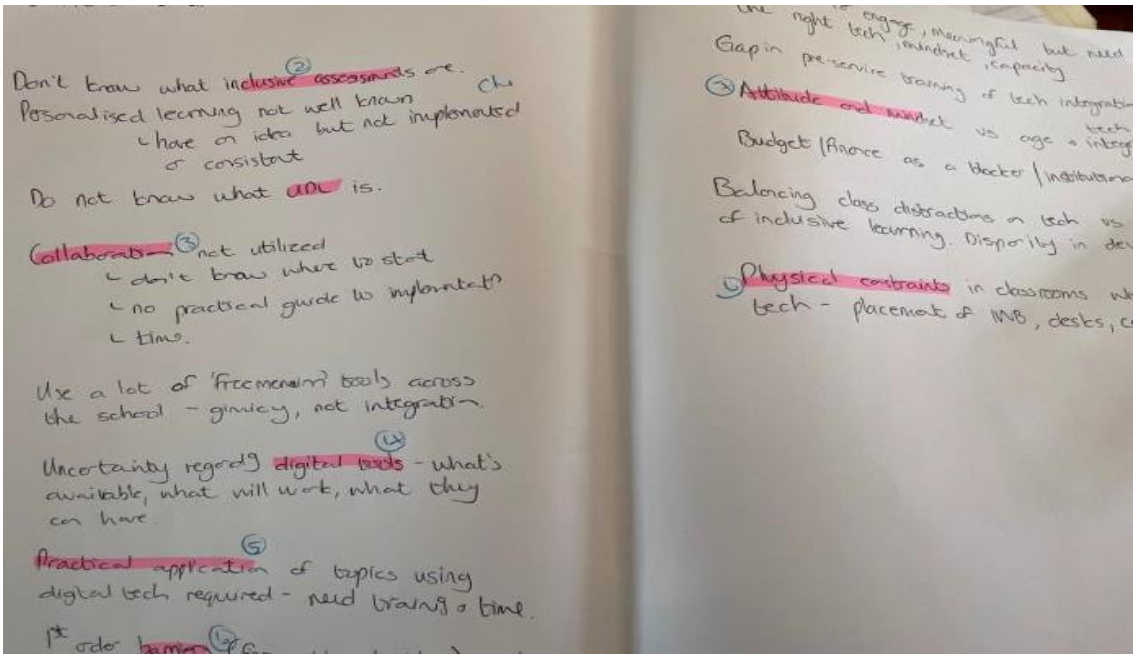

Figure 5: Key theme identification in survey data

3.5.2 Data storage and security

All collected data was stored securely to ensure confidentiality and privacy. Once the teachers had completed the survey, the digital data was exported into Excel and uploaded to the researcher's UCT OneDrive where the researcher could access the data as needed. The UCT OneDrive is a password-protected, cloud storage system. This locked file was only shared with the researcher's direct supervisor. Physical data from observations was stored in the researcher's locked office before being digitised and then destroyed. Personal identifiers of all participants were removed to anonymise the data, ensuring participants' anonymity in reports and publications. The data is organised in clearly labelled folders and subfolders with transcripts labelled by the participant code and session type for easy retrieval during analysis. All metadata is included with the files type for traceability.

3.6 Data analysis

Constant comparison analysis was used to analyse the data. Constant comparison analysis emerged as a valuable research approach for investigating the effective utilisation of digital technology in teacher development for fostering inclusion. This method facilitates the systematic analysis of qualitative data, encompassing interviews, observations, and educators' experiences to discern emerging patterns, themes and strategies (Babbie & Mouton, 2002). The iterative nature of constant comparison permits the inductive development of theories and concepts grounded in educators' lived experiences. This approach aids in revealing the varied utilisation and non-utilisation of digital technology, and the challenges and successes educators encounter in their pursuit of inclusion.

Design-based research (DBR) was used to comprehensively examine the current reality of in-service teachers and work towards design principles that can be applied in future teacher training. This research will follow the four phases of DBR (Herrington & Reeves, 2011).

3.7 Description of intervention

Design-based research (DBR) was employed to iteratively explore how exposure to digital technologies and inclusive practices shifts in-service teachers' practices. The phased iterative approach was used to comprehensively examine the current reality of in-service teachers, and work towards design principles that can be applied in future teacher training. This research followed the four phases of DBR (Herrington and Reeves, 2011). DBR was used as a research framework and not a theoretical approach, as DBR allowed the researcher to analyse the problem using Archer's (2020) morphogenetic approach, run multiple interventions to assess the shift in behaviour, and/or attitude towards digital technologies due to the interventions.

3.7.1 Phase 1: Analysis of the problem

The first phase involved an examination of the current teaching practices in an independent girls' school in Cape Town. Teachers in the senior and preparatory schools were engaged through a structured survey in January and February 2024 to determine their views on inclusive education and

digital technologies, as well as assess their perceived preparedness to address the challenges encountered in inclusive education, including using digital technology to mitigate these challenges within the classroom setting. This allowed the researcher to determine T1 and T2 from Archer's morphogenetic approach (Archer, 2020). The teachers in this study are in-service teachers with varying degrees of digital skills and teaching experience. There are 110 in-service teachers who are either permanently employed or occupying locum positions across both the senior and preparatory schools. All 110 permanent and locum teachers were sent the initial survey questionnaire to complete. Of the 110 teachers surveyed, 81 responded to the questionnaire: 38 participants from the senior school; 35 from the preparatory school; and 8 pre-service teachers in the senior school. The data collected from all teachers, both senior- and preparatory-school teachers, was used for overall results. This data allowed the researcher to plan and implement the first intervention.

3.7.2 Phase 2: First intervention

In April 2024 the first intervention took place, where the senior-school teachers were introduced to a set of digital tools they were required to implement over the remainder of the academic year. The session highlighted the findings from the initial survey. This intervention took place in person, where teachers attended a training session to equip them in using new digital technologies, such as generative artificial intelligence, in their planning and delivery of lessons. This allowed teachers to share and experience the digital technologies in their own space. Teachers were asked to complete tasks and activities that replicated what they are required to do in their day-to-day activities. Teachers then brainstormed how to apply the technology in their departments. The initial intervention brought in experts' voices through video and examples of documents that could be produced in a classroom (Chiu et al., 2018). Teachers could see real-world examples of how digital technologies were being used in other schools, globally and locally. Teachers explored different applications of the technologies to assess their versatility and application in their classroom through a sharing session across departments. Teachers were required to share their application of the technology to identify where there was potential for collaboration across departments. This was extended in a collaboration project that was rolled out with the Grade 9 learners.

Teachers worked in their departments and shared their experience, coaching each other and building knowledge based on their own and others' experiences. The researcher attended these departmental meetings as needed, depending on the department's digital technology uptake and coaching requirements, as observed in the classroom where teachers implemented their choice of digital technology. This was shared with the researcher during the one-on-one subject-head interviews, as well as during subsequent interventions run during staff development sessions with the broader group of teachers. Teachers used the knowledge gained through the initial and subsequent interventions in a lesson of their choice, with support from the researcher.

3.7.3 Phase 3: Further interventions

Between April and June, six subject heads across the senior school were identified and interviewed (question set in appendix). The interviews were structured and consisted of 18 questions. The 18 questions covered the key areas of inclusion, structure, culture, agency and digital technology experiences in the school. Each interview took approximately 25-30 minutes to complete, and all interviews were recorded and then transcribed. The data from this interview was used to inform the

uptake of digital technologies and the current understanding of inclusive education in the senior school. This data was used to inform further interventions in staff development sessions and departmental meetings. After the interventions, eight teachers were identified as digital technology super-users and received new interactive whiteboards. These super-users were interviewed to determine how the new software as well as hardware had impacted their teaching and learning practices and therefore the learning experience in the classroom. The "super-user" interviews were unstructured, lasting 15-20 minutes. These interviews were recorded and transcribed.

The second in-person, senior school intervention took place in July 2024 where the full senior teaching staff explored how they make decisions and show up for each other. This session was followed by smaller group staff developmental sessions on how they will roll out Microsoft Education for engaging with staff and pupils, as well as storing and sharing content, lesson plans, and collaboration documents. These sessions allowed teachers to practice using the tool and to voice how they envisioned its application in their classrooms. Department specific workshops were set up to streamline the digital technology needs within each department and define how departments would approach the use of technology to meet the needs of the subject and the pupils. These departmental workshops were led by the subject heads with support from the ICT Integrator and Coach. The "super-users" (mentioned above) were trained on how to enhance teaching using an interactive whiteboard. These teachers were selected based on their current use of technology in the classroom, their subject requirements and current hardware usage. Post the set up and training on the new interactive whiteboards the eight teachers were interviewed to determine how technology shifted their teaching practices, if at all.

3.7.4 Phase 4: Development of design principles and products

Based on these interventions in the senior school, the cross-curricular staff development sessions, departmental workshops and interviews with subject heads and teachers, global design principles for digital technology implementation within the school were defined including how training and development would roll out on a continuous basis.

3.8 Ethics

"Ethical choices involve a trade-off or compromise between the interest and rights of different parties" (Babbie & Mouton, 2002, p. 520). When undertaking research, the researcher needs to be trustworthy, courageous, honest and have concern for the well-being of others (Williams, 2009). In exploring this topic, the aim is to understand how digital technologies are used to create an inclusive learning environment for the betterment of education in South Africa in particular. As stated in Williams (2009) the personal identity of the researcher is vital in this type of research where the researcher is intimately connected to the research subjects. As a result, the researcher must make moral judgements within the context of this research, these give rise to ethical dilemmas which cannot be addressed by ethical codes alone but also on personal morals (Williams, 2009).

"Researchers have the right to collect data through interviewing people, but not at the expense of the interviewee's right to privacy" (Babbie & Mouton, 2002, p. 520). When engaging in this research, I informed all teachers in the school that I would be conducting research in their use of educational

technologies and the potential impact on the creation of an inclusive learning environment. All teachers were informed that any responses to surveys or interview questions would be treated with anonymity and their confidentiality would be protected, with all data being destroyed after ten years. Pseudonyms were used to anonymise data, and sensitive information was stored securely. As with all research, no one should be forced to participate, and all teachers were given the opportunity to choose to be included or not (Babbie & Mouton, 2002).

As my research is linked to my role within the school, I have been very clear with all participants that any information I gain from working with them will benefit and not harm them during or after the research. The information I gain will assist me in exploring how the school can develop their skills where necessary and my research findings will not impact their performance reviews in any way. There are times when the truth can be harmful rather than beneficial and, in this case, I must ensure I do no harm to the participants (Williams, 2009). During the research I invited all participants to review the data gathered and shared whole school anonymised data with all participants. Where individuals were interviewed, they were invited to read their transcripts and ask any questions regarding how I had interpreted their input. I also needed to employ reflexive thinking when analysing the data collected and reflect on my own preconceptions regarding the outcome, my emotional state during the intervention and the impact on the data, how my life experiences are reflected in the data and how the participants experienced me (Wilkie, 2015). Reflexive thinking allows me to morally deliberate within the context of my research thus reflecting the trustworthiness of the study (Williams, 2009).

3.9 Validity

The idea of validity in qualitative research is much debated. What is vital though when determining validity is that "understanding is a more fundamental concept for qualitative research" (Maxwell, 1992). This research aims to understand how teachers experience technology in their classrooms and the impact that technology has on the inclusivity of their classrooms. As a teacher in the school where the research took place, the researcher cannot step outside of her own experience of the school and how teaching and learning is impacted by technology, thus validity may be impacted by her perspective (Maxwell, 1992).

All teachers involved in the study were informed of the purpose of the research, procedures and potential risks or benefits prior to completing the survey, and before attending the in-person interventions and interviews. This fulfilled the informed consent for validity requirement (Maxwell, 1992). All teachers understood they could withdraw at any time, or refuse to answer any questions, without consequences. To ensure inclusion and diversity, the full teaching staff was included in the surveys and all senior teachers were included in the in-person interventions. Subject Heads from different departments and eight super-users were interviewed to include different perspectives. The teachers varied in backgrounds and career trajectories, which allowed for cultural, gender and age perspectives to be included. The researcher recognises that teachers are in a learning phase regarding digital technologies and may have limited experience. The interventions were approached in such a way to set participants at ease regarding their level of understanding or incorporation of digital technologies.

The use of multiple methods and triangulation allows for the researcher to rise above personal biases that could result when employing a single methodology (Babbie & Mouton, 2002). The study

employed a variety of forms of qualitative research, including interviews, surveys, workshops and observation. The variety in interventions allowed the researcher to triangulate the data and look for convergent evidence. This methodological triangulation was done through graphical representation of the data, which resulted in the researcher being able to make linkages between the different data points. These linkages will be discussed in the results but should be highlighted here as they allow for increased validity in the results.

This study has limited validity as the sample group of teachers is from an independent, well-funded school in the Southern Suburbs of Cape Town. Although the school is differently resourced to many schools in South Africa, the teachers themselves reflect a diverse group as they come from a variety of public and private schools. Their uptake and attitude to digital technologies and the potential role they play in creating inclusive learning environments reflects the potential for digital technology as an inclusive tool in South Africa. A limitation that should be raised now is that the rapid evolution of digital technology could make the study's findings less relevant over time. This limitation can be mitigated by considering a set of guidelines for using technology in general, rather than specific technologies that may become dated.

3.10 Conclusion

This chapter outlined the methodological approach used to generate data for the study, with Design-based research (DBR) serving as the central framework. DBR was selected for its iterative, context-sensitive, and intervention-oriented nature, making it well-suited to exploring and enhancing inclusive practices through digital technology. A mixed-method approach was adopted with a survey being administered to all teaching staff to establish a comprehensive baseline of current practices, beliefs, and challenges related to inclusive technology use. Findings from the survey informed the intentional sampling of senior-school teachers, subject heads and super-users for the subsequent qualitative phases.

To build on the quantitative data, semi-structured interviews were conducted to gain detailed insights into teachers' experiences and decision-making processes, while classroom observations allowed for the direct examination of inclusive practices as they occurred in real settings. These observations were complemented by the implementation of targeted interventions to trial and refine specific inclusive technology strategies. Throughout the research process, ethical considerations were upheld, including informed consent, participant confidentiality, and reflexive practice. The results generated through this layered and iterative methodological design are presented and discussed in the following chapter.

Chapter 4: Findings

4.1 Introduction

This chapter will explore the findings from the various interventions conducted with the teachers in the case study school, focusing on how digital technologies are being integrated into teaching practices and the influence on inclusive education. The findings were categorised and reinterpreted using Margaret Archer's morphogenetic approach (T1–T4) and the framework of first-, second- and third-order barriers to technology integration as defined by Ertmer (1999) and Tsai et al. (2019). The narrative below explores how structural, cultural and personal factors interact to shape the integration of technology and inclusive practices within the case study school.

The analysis is based on the results of a whole-school teacher survey, which gathered data from across the school, providing a comprehensive overview of the teachers' experiences, attitudes and challenges related to professional development and technology use. While the survey covers the entire school, particular attention is given to the senior school, where technology integration differs due to the specific curricular demands and subject areas. The outcomes from a series of in-person workshops held with senior-school teachers are explored, where the workshops were designed to foster collaborative discussions around the use of digital tools and inclusive education practices, highlighting both the successes and areas for improvement identified by the participants. In addition, the chapter presents the findings from interviews with subject heads and super-users to provide a multi-perspective view of how the school's leadership structures, policies and cultural norms shape the use of technology and the professional development opportunities available to teachers. As previously discussed, teachers have professional development opportunities through SACE, the Independent Exam Board (IEB) and the WCED; this chapter includes how these external resources are utilised in conjunction with internal development offerings provided within the school. The analysis considers the extent to which these opportunities are effectively supporting teachers in enhancing their digital literacy and creating more inclusive classrooms.

4.2 T1: Structural conditioning – the starting context

Starting at T1 Structural Conditioning, we understand that the school operates within a complex environment influenced by existing policies, resources and cultural attitudes towards technology (Figure 2). The integration of technology and inclusive practices in the school are shaped by a range of structural, cultural and personal factors, which shape both the types of digital tools teachers use and the frequency with which they use them (Figure 6). These pre-existing conditions highlight challenges at multiple levels, reflecting Ertmer's (1999) and Tsai and Chai's (2012) classification of barriers into first, second and third orders. One teacher mentioned that, "If there's group work happening, there's always going to be some child, some poor child is left out. Whether it's because they're not cool enough or they're not clever enough or however they are seen by the class."

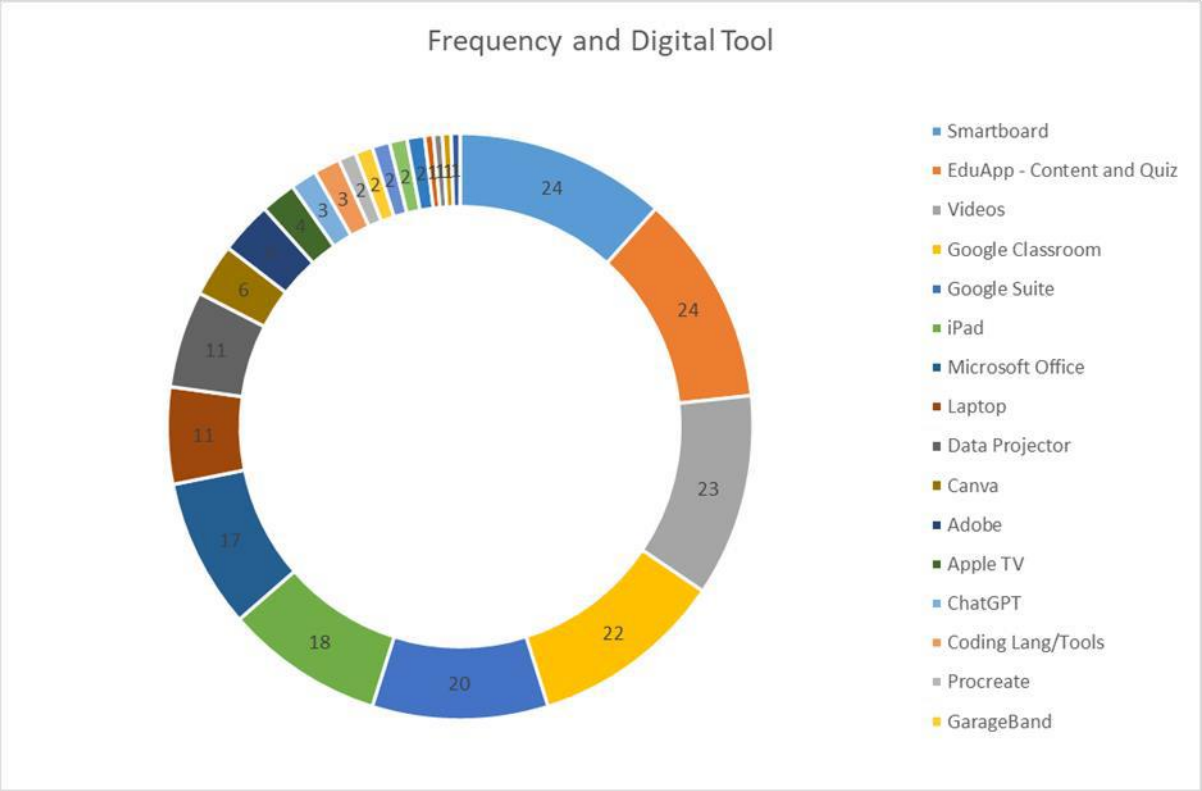

Figure 6: Frequency of digital tools used

First-order barriers are particularly evident in the school's outdated infrastructure and inequitable access to resources. For example, some interactive whiteboards (IWBs) lack updated licenses, limiting their functionality and creating frustration among teachers who cannot fully utilise these tools. A frustrated teacher mentioned, "I have a smartboard but the school doesn't have the software to allow it to work. I've asked a few times about it, but it seems to be a big hassle." Device disparity among students further compounds these challenges, as the quality and availability of iPads or other tools often vary, impacting learners' ability to participate equally in classroom activities. Additionally, technical issues such as frequent recalibration requirements and unreliable connectivity undermine the reliability of these resources, deterring teachers from incorporating them consistently.

At the second-order level, teacher beliefs and skills play a significant role in shaping how technology is adopted. A subject head mentioned that she "think(s) everybody's own insecurities are standing in their way." Older teachers, in particular, express apprehension and a lack of confidence in using digital tools, which often stems from limited exposure or negative experiences with technology in the past. This apprehension is intensified by insufficient training on concepts critical to inclusive education, such as Universal Design for Learning (UDL) (Figure 7). Without a strong understanding of UDL principles or how to leverage technology for personalised learning, many educators struggle to address the diverse needs of their students effectively and let their own attitudes or stereotypes dictate how they engage (their unconscious bias). One of our teachers reflected on individual bias in an interview and said:

> "Nobody takes to the change, I don't think, particularly easy. I think change is hard for all of us. It doesn't matter how keen you are, but it's the approach to that change. (One teacher in our department) once she is confident with something, she will do it well. But she wants those clear parameters and she doesn't have them... And for her, just I

think given her context, it's not yet seen that we need the fuzziness (uncertainty). (But) our world is fuzzy (uncertain)."

In this case, one teacher is choosing to avoid using technology as she does not understand it yet and does not want to deal with the "fuzziness" (uncertainty) of incorporating a new teaching tool into her classroom. This is a decision based on her unconscious understanding of the world around her and her role in it; and links to Staats (2015), where she states that perceptions can prevent us from even trying to use technology.

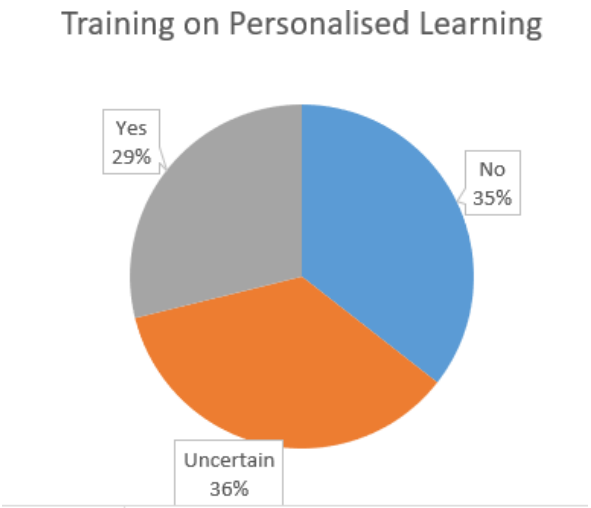

Figure 7: Teachers trained on the concept of 43personalised learning

Third-order barriers, which reflect systemic and organisational factors, further complicate the integration of technology. One key issue is the lack of alignment between institutional policies and teacher experiences. While school leadership articulates the importance of integrating technology into teaching, 18% of teachers report unclear expectations regarding its use. This disconnect points to inconsistencies in policy communication and application, which can leave educators uncertain about their responsibilities and hinder widespread adoption of digital tools. Moreover, generational divides within the teaching staff shape the school's cultural attitudes towards technology. Younger teachers generally display a greater openness to innovation, while more experienced educators may be slower to embrace change, creating a fragmented approach to technology use across departments. One teacher stated that digital use relied more on attitude than age when she said:

"I think, and perhaps a little bit of personality, like if someone is willing to be open to learn something new, then it's probably not a problem. But if people are too set in their ways or too rigid, that would be way too much of a challenge and probably would be avoided."

A subject head summarised why it's difficult to integrate digital technologies in her comment:

"I think just me as a teacher, there's only so much time I have to learn, and know, and show. So, in terms of the curriculum that we have set up in the country, it's not very inclusive of all of these things."

These structural conditions, encompassing first-, second- and third-order barriers, create a challenging foundation for advancing technology integration and inclusive practices. They reveal the need for a multi-layered strategy that addresses external limitations, supports teacher development and aligns institutional goals with practical implementation.

4.3 T2: Social interaction – actions in response to conditions

The interplay between teachers and their conditioned environment reveals both the barriers they encounter and the strategies they employ to integrate technology into their teaching. These interactions highlight a range of challenges, particularly in collaboration, attitudes towards technology and practical implementation.

Collaboration and communication among teachers is limited, often constrained by time pressures and a lack of structured opportunities for meaningful engagement. While there are pockets of collaboration within specific departments, such as Mathematics and between Drama and Visual Arts, these efforts tend to be isolated. Teachers frequently express the need for more intentional and cross-departmental initiatives that allow them to share resources, strategies and best practices more effectively. One teacher stated, “I think it is meant to happen in Staff Development but it doesn’t always. I’ve found the conversations in these sessions either very ‘philosophical’ (rather than practical) or very surface level.” The absence of systemic platforms or frameworks for collaboration further reinforces the fragmented nature of these interactions, leaving many teachers to navigate technology integration in isolation. Teachers are not trained in how to use the tools available for collaboration (Figure 8) and are expected to create collaboration opportunities across too many types of teacher engagement platforms (Figure 9).

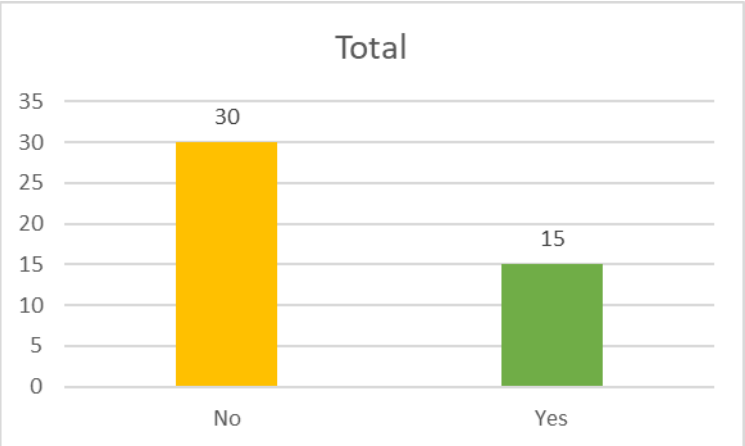

Figure 8: Number of teachers trained on communication tools

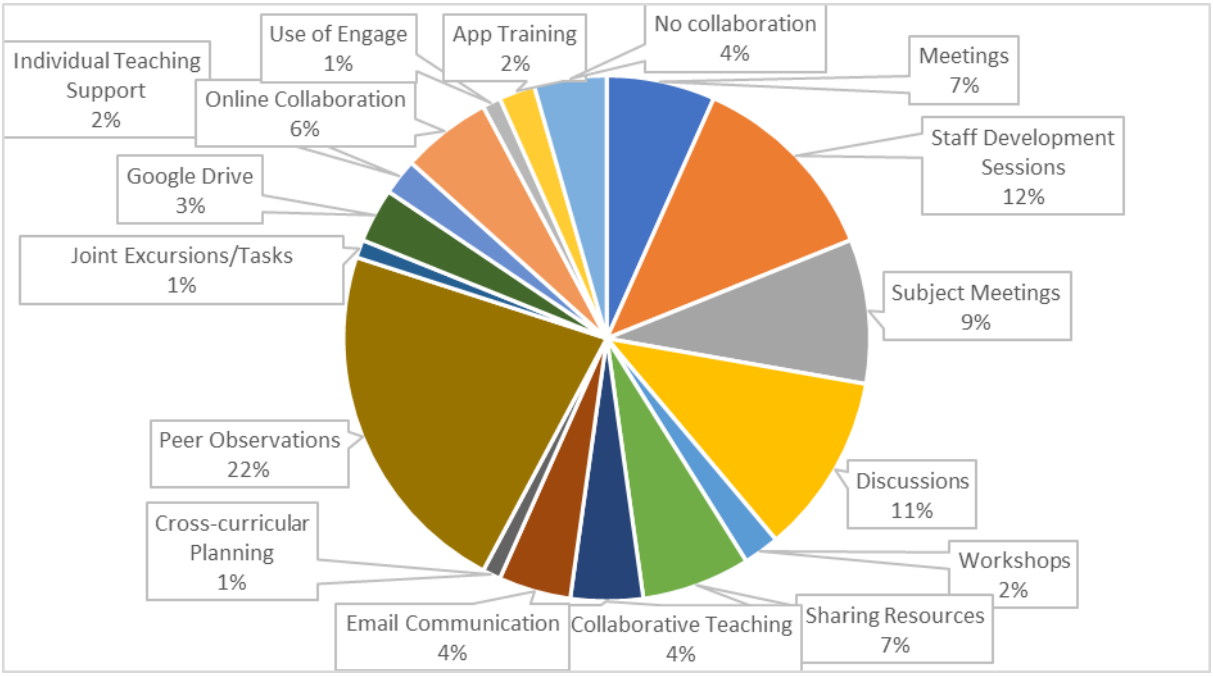

Figure 9: Types of engagement for in-service teachers

Teacher attitudes towards technology are similarly diverse, creating disparities in how digital tools are adopted and used. This confirms Staats' (2015) findings: that teachers may choose not to use technology based on their implicit bias that digital technologies are bad for learning, or on the opposite side, we can teach better with them. On one end of the spectrum are enthusiastic educators who actively self-teach and experiment with tools like Google Classroom, Turnitin, Canva and other platforms to enhance their teaching. These teachers often serve as informal advocates for technology, demonstrating its potential to their colleagues. Conversely, some teachers resist using technology, citing a lack of confidence or familiarity as primary reasons. This resistance is compounded by gaps in training, with fewer than half of senior-school teachers participating in available professional development opportunities. As a result, disparities in technology use persist, influenced by both individual agency and broader structural barriers. In reflecting on the use of technology in the classroom, one teacher stated:

> "Well, I think designers are probably going to have to find that marriage, that balance between technology and the analogue. Because I think, yeah, I think our careers and our industries, there's going to be a lot more collaboration than there already is, between designers and engineers, or biologists, or whomever. But I think as designers, one does have to have a lot of, like a big skill set, because you've got to know how to conceptualise something, how to create something, what materials to use, what the properties of those materials might be. And then you've got to look at the need of the user. So, it's a complex marriage of many, many things, including technology."

The practical application of technology in the classroom reflects this variability. For some educators, tools like interactive whiteboards (IWBs) have proven highly effective in enhancing lesson continuity and student engagement. Teachers have used IWBs to build on work across lessons or to create interactive experiences that capture students' interest. However, these successes are not universal. Persistent technical issues, such as recalibration problems, have led some teachers to abandon IWBs in favour of traditional methods. One of the super-users struggled with her IWB stating:

"it (the training) was very interesting and exciting. I was like, I can't wait to try this out. But then, I didn't even know how to plug my board in when I got back to my classroom. And then, there was the calibration issue, it worked nicely for about one lesson."

This inconsistency in implementation underscores the need for reliable infrastructure, ongoing technical support and comprehensive training, to address both technical and pedagogical challenges.

Overall, the interactions between teachers, their colleagues and the available technology reflect a mixed landscape. While some educators make significant strides in leveraging digital tools, others remain hindered by systemic constraints and personal apprehensions (Figure 10). These findings point to the importance of fostering a more collaborative culture, providing targeted support and addressing technical barriers to ensure that all teachers can effectively engage with technology in their practice.

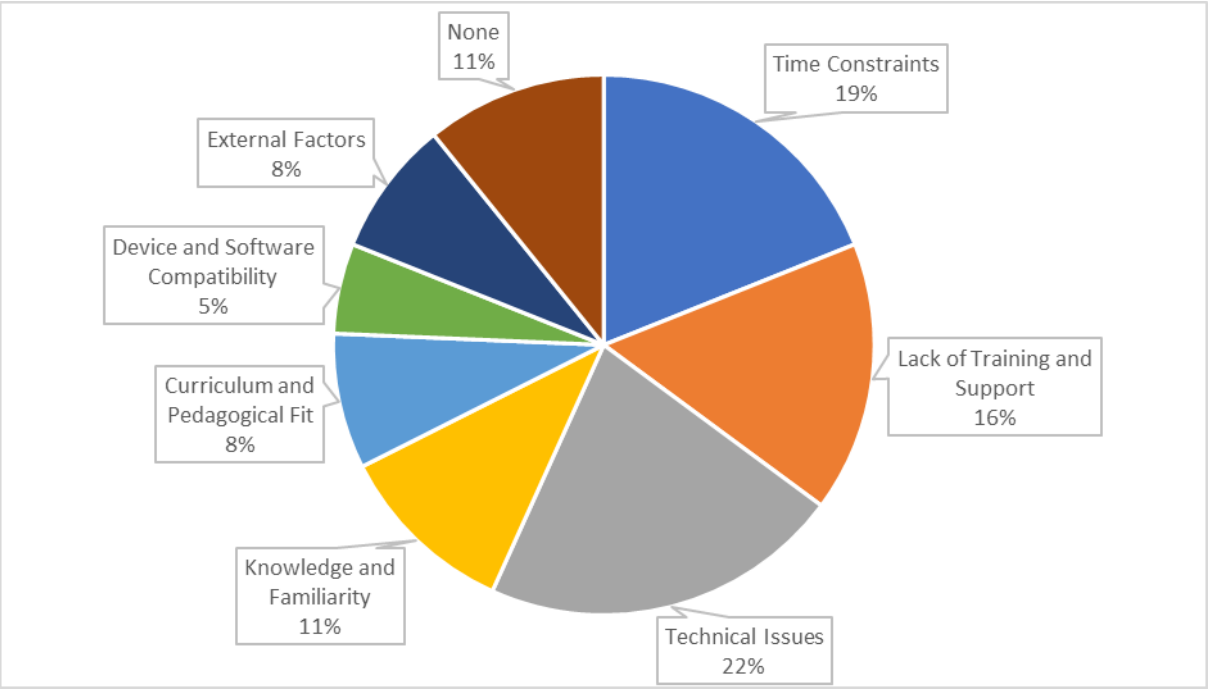

Figure 10: Challenges faced when implementing digital technology

4.4 T3: Structural elaboration – outcomes of interactions

The outcomes of teachers' interactions with technology – and interactions with their peers – reveal a dual narrative of progress and persistent challenges. These results reflect both advancements in practice and systemic limitations that continue to shape the school's technological and pedagogical landscape.

First-order successes provide evidence of the positive influence that technology can have on teaching and learning. Teachers report notable improvements in student engagement, particularly with interactive tools and subject-specific applications. For example, platforms like Canva enable learners to explore creative tasks, while digital simulations in Physical Sciences enhance conceptual

understanding through visualisation and experimentation; videos in Mathematics allow for concepts to be explored independently. In an interview with the Physical Sciences teacher, she spoke of digital technology having:

> "…an important place for actual practical hands-on experiments where you are working with physical entities and you are investigating physical or chemical phenomena without a doubt. So, you're using up-to-date technology to demonstrate the same thing more effectively and more accurately. So that in some of our traditional experiments, in simulations, (it) was just so lifelike. The practicals are great in teaching them (the students) to mess up, fail the group work, all those social elements, and get your hands dirty in 3D. The simulations were fantastic and really drive the physics home."

These tools not only foster engagement but also allow for new avenues of differentiated instruction, enabling teachers to better cater to diverse learning needs.

At the second-order level, teacher agency is emerging as a significant factor in advancing technology integration. Many educators are growing in confidence as they experiment with digital tools, demonstrating adaptability and resilience. For instance, interactive whiteboards (IWBs) are increasingly used to build lesson continuity, allowing teachers to save and extend work across multiple sessions. In reflecting on her use of the IWB, one teacher said:

> "Before the board was installed, I had drawn a timeline on my whiteboard just to give them a context for what we were doing. I took a photo of that at one point. And then once the board was installed, I put that photo onto whiteboard and then I could extend the timeline. I like drawing literally from the image paste on whiteboard. And then I could kind of build lessons around that. So that was very cool."

Similarly, the use of recorded videos and online collaboration platforms mentioned by teachers highlights how they are leveraging available resources to enrich their instructional practices. These examples illustrate a shift in mindset, with teachers beginning to see technology as an enabler of their pedagogical goals rather than an obstacle.

Despite these individual successes, third-order challenges persist at the systemic level. Professional development opportunities, while impactful when available, remain inconsistent and erratic. This lack of structure limits teachers' ability to gain the skills and confidence needed for sustained technology integration. Additionally, collaboration across departments is often siloed, with limited cross-curricular engagement or opportunities to share best practices. These systemic issues contribute to a sense of inertia, where broader institutional change is slow to materialise.

Nonetheless, there are signs of progress in some departments, where inclusive practices are gaining traction. Educators are beginning to integrate personalised learning methods and technology to create more adaptable classrooms. These efforts demonstrate the potential for structural elaboration, where positive interactions and innovations at the individual or departmental level could eventually drive broader systemic improvements. Overall, while the outcomes of teachers' interactions with technology reflect uneven progress, they also highlight key opportunities for growth. Building on these successes and addressing systemic barriers will be critical to fostering a more cohesive and inclusive technological culture within the school.

4.5 T4: New conditioning – future opportunities and challenges

The evolving structural and cultural conditions within the school highlight emerging opportunities and persistent challenges, providing a roadmap for future advancements in technology integration and inclusive practices. Schools that promote a culture of innovation and allow teachers the freedom to tailor technology use to meet diverse learning needs tend to encourage teachers to exercise greater agency in thoughtfully and inclusively adopting digital tools.

At the first-order level, teachers are advocating for updated resources and equitable access to technology as foundational requirements for progress. One teacher said, "I think it (technology) should be used in everything really, that's the world we're living in, technology is here to stay." The need for modernised licenses, reliable hardware and consistent infrastructure is repeatedly emphasised, as these elements are essential to creating inclusive learning environments. Teachers identify platforms like Microsoft Teams and OneNote as tools with significant potential to facilitate collaboration and streamline communication, particularly across departments. These platforms also hold promise for enabling more flexible and personalised learning experiences for students. This is highlighted in a comment from the learning support teacher:

> "Whether you're dyslexic or not, you can still have something read to you if it's faster for you and easier for you. It doesn't matter what our difficulties are. So, if everybody was taught all the different methods and then they could choose what worked for them."

Addressing these resource gaps will be critical in reducing disparities and ensuring all learners and teachers can benefit from available technologies.

Second-order conditioning focuses on the growing recognition among teachers of the importance of professional development. There is a clear demand for training that is both practical and subject-specific, equipping educators with the skills to integrate technology effectively into their teaching. For instance, Mathematics teachers express interest in tools like Desmos for graphing and problem-solving, while creative subject teachers seek to utilise platforms like Canva to enhance student projects. By aligning professional development offerings with these specific needs, the school can empower teachers to feel confident and competent in their use of digital tools, fostering a culture of continuous learning and innovation.

At the third-order level, the need for systemic reform emerges as a key theme. Teachers call for greater alignment between institutional expectations and their own agency, emphasising the importance of clear, consistent policies that support sustainable digital integration. Structured collaboration frameworks are also highlighted as essential for fostering cross-departmental sharing of resources and strategies. One teacher responded with, "I find there is not enough time for intentional collaboration; I would love more time with teachers to plan collaboration, particularly cross-curricular." Newer teachers express a growing optimism about the transformative potential of technology in education. While they recognise barriers such as access disparities and inadequate support, their positive outlook reflects a shift in cultural attitudes that could drive long-term change. Harnessing this enthusiasm and addressing the systemic barriers will be essential for creating an environment where technology is embraced as a central component of teaching and learning. In terms

of using technology to address barriers, one teacher said that teachers should, "encourage use of devices of choice for typing or writing tasks and offer one-on-one support for struggling students."

The structural and cultural shifts underway offer a foundation for meaningful progress. By addressing resource inequities, prioritising targeted professional development and implementing systemic reforms, the school can create an inclusive and future-focused educational environment that empowers both teachers and learners. The integration of technology and inclusive practices in the school reflects the dynamic interplay of structural, cultural, and personal factors over time. When discussing the use of digital technology and training needs, a teacher stated that:

> "I would love everyone in our department to feel comfortable working with digital tech, to centralise and improve communication around our department administration, as well as our classroom administration. I would also like to see our whole department make far more use of simulations in teaching. We have varying degrees of proficiency amongst our staff."

While first-order barriers such as outdated infrastructure remain significant, second and third-order challenges such as teacher confidence, training gaps and unclear policies also play a critical role. The findings suggest that addressing these barriers holistically, through updated resources, structured professional development, and cultural shifts, is essential for fostering a more inclusive and technologically integrated educational environment.

4.6 Conclusion

This chapter highlights the multi-faceted challenges and opportunities in integrating digital technologies into teaching practices within the case study school. Using Margaret Archer's morphogenetic approach and Ertmer's framework of first-, second- and third-order barriers, the chapter explores how structural, cultural and personal factors interact to shape technology adoption and inclusive education in the chosen school. First-order barriers such as outdated infrastructure, unreliable connectivity and inequitable access to devices hinder consistent technology use. At the second-order level, teacher apprehensions, influenced by bias and insufficient training, limit the potential for technology to support diverse learner needs. This inconsistent use of technology due to unclear policies and fragmented collaboration frameworks illustrates the interplay of structure and agency at the T1 and T2 stages. Third-order barriers, including unclear institutional policies and inconsistent professional development, exacerbate these issues, leading to fragmented practices across departments. Despite these challenges, promising developments are noted. Teachers report enhanced student engagement through tools like Canva and interactive whiteboards, while some educators demonstrate agency by creatively integrating technology despite constraints. The examples of teachers creatively leveraging tools like IWBs despite technical challenges reflect emerging morphogenetic change at the T3 level. These findings emphasise the importance of addressing systemic and individual constraints to enable a shift toward more inclusive and innovative educational practices. The chapter underscores the need for systemic reforms, targeted professional development and reliable infrastructure to support a cohesive, inclusive approach to digital integration. The next chapter will discuss how the school can foster a culture where technology enhances both teaching and learning by leveraging these interconnected factors.

Chapter 5: Discussion

5.1 Introduction

This chapter explores the interplay of training, structure, culture and agency in shaping teachers' use of digital technology and its potential to foster inclusive education. The findings are interpreted using Margaret Archer's (2020) morphogenetic approach (MM model) and Ertmer's (1999) framework of first- and second- order barriers, enriched by Tsai et al.'s (2012) work on third-order barriers. The discussion critically examines the structural and cultural enablers and barriers, teacher agency in technology adoption, and the role of digital tools in inclusive practices, highlighting how bias intersects with these dynamics. Archer (2020) highlights that "structure" refers to the social systems, rules and frameworks that shape our environment; "culture" is both an ideational unity and a community that is integrated into a common way of life; while "agency" refers to individuals' capacity to make decisions and take actions within those structures. Though they are distinct entities – structures exist independently of individual action, and agency reflects the choices individuals make – they are interdependent because the actions individuals take (agency) can modify or reinforce the structures over time, and those structures, in turn, constrain or enable the individuals' actions (Archer & Morgan, 2020). The interplay between structure, culture and agency is evident in the findings as emphasised by Archer (2000, 2003, 2020).

5.2 The influence of training, structure, culture, and agency

The integration of digital technologies in the case study school is influenced by a dynamic relationship between structural resources, cultural attitudes and teacher agency, as explained through Archer's (2020) MM model. At the T1 stage (Structural Conditioning), structural and cultural elements define the initial conditions that shape teachers' engagement with technology. Drawing on Archer's (2003) principle that "every current emergent structural property has a history", the systemic inequities in training access and digital infrastructure reflect longstanding barriers. These limitations represent morphostatic tendencies, where outdated infrastructure and insufficient training have perpetuated existing challenges rather than transforming the system into a more inclusive one.

As discussed previously, implicit bias refers to the unconscious attitudes or stereotypes that influence our decisions and actions, while explicit bias involves conscious beliefs or attitudes that we are aware of and may openly express. Teachers in this study displayed apprehension to using digital tools based on their confidence in using the tool, as well as their own bias towards digital tools. Teachers deal with changes brought about by technology everyday (De et al., 2024). Their bias determines how they engage with these changes in technology. Teachers require not only content knowledge but also pedagogical and technological knowledge (TPACK) to effectively integrate technology into their teaching (Tsai & Chai, 2012). Implicit and explicit biases towards technology can limit their ability to fully harness its pedagogical potential, as teachers may either unconsciously resist new tools or consciously dismiss them, hindering the enhancement of both pedagogy and content through technology (Kim et al., 2013).

Teachers in the school demonstrate a commitment to integrating digital tools wherever possible,

motivated by a cultural shift towards recognising technology's potential to enhance learning. However, structural barriers, including outdated resources and inequitable device access, frequently undermine these efforts, creating tension between their aspirations and practical realities. Ghavifekr and Rosdy (2015) speak to the rate of change in technology, which requires constant updating and training. This is supported by Timotheou (2023) and Scherer et al (2019) who both state that the right technologies need to be used to allow for multi-modal teaching and learner engagement.

Structural barriers, such as non-functional interactive whiteboards (IWBs), unreliable connectivity and outdated infrastructure, represent significant first-order impediments. These challenges are further exacerbated by unclear expectations (third-order barriers), where teachers are uncertain about their responsibilities in integrating digital technologies. Klopfer et al (2024) speak to the rise of digital tools including IWBs, which promised wide scale educational disruption but failed to deliver as it was not as simple as just using the tool; pedagogical change was required. Despite this uncertainty regarding digital tools, cultural attitudes within the school reveal a growing openness to digital innovation, particularly among younger staff and super-users who champion technology use and model effective practices. However, cultural divides remain. The data showed that generational differences influence attitudes towards technology: older teachers often express apprehension and a lack of confidence; teachers mentioned that perhaps it's less about age but more about personality and being scared of change. These hesitations are shaped by limited training and exposure to technology during their early careers, perpetuated by structural gaps in professional development (Kim et al., 2013). Consequently, the interplay between structure and culture creates a fragmented environment where teachers are committed to innovation but constrained by systemic inconsistencies. Wray et al (2018) and Salas-Pilco et al (2022) speak to this interplay between culture and structure and reflect on how teachers need to lead the drive to change in implementing digital technologies with support and training from management for it to be effective.

The school's ability to align structural and cultural elements is critical to supporting teachers' integration of digital tools. For example, external professional development opportunities (e.g., through SACE and IEB) complement internal workshops but need to be more targeted and responsive to teacher needs. Wray et al. (2018) and Timotheou et al. (2023) maintain that teachers need to create the learning environment for themselves to develop the digital competencies they require. Cultural norms promoting collaboration and peer learning can be leveraged to counter structural limitations, such as providing mentorship opportunities where more confident teachers support their peers. At the T2 stage (Social Interaction), teachers' responses to these conditions illustrate the interplay between structure, culture and agency. The presence of super-users and informal mentorships highlights emergent morphogenetic change. Teachers who leveraged their agency to self-teach or mentor peers began to challenge structural constraints and foster a collaborative culture of innovation. Other teachers, however, remain hesitant, constrained by systemic biases and limited training on frameworks like Universal Design for Learning (UDL). For these teachers, the lack of accessible, practical training reinforces a sense of exclusion, further widening the gap between aspiration and action. Christiansen and Bertram (2019) highlight the importance of teachers being equipped with the knowledge and skills to challenge existing ways of teaching and how current teacher training does not meet this need.

Structural reforms, such as investing in updated resources and providing equitable access to devices, are foundational. Simultaneously, fostering a culture of innovation through clear policies, consistent

professional development and intergenerational collaboration is essential. Krischler and Pit-ten Cate (2019), Wray et al (2018) and Peruzzo and Allan (2022) all speak to the importance of challenging the current curriculum, transforming learning practices and allowing learners to be supported where they are, through collaboration between learners and teachers, and through leveraging technology where appropriate. By bridging the gap between structure and culture, the school can create an environment where teachers feel both empowered and supported to integrate technology (Archer, 2003). This approach requires recognising and addressing the barriers at all levels – structural, cultural and individual – while celebrating and amplifying the commitment and agency many teachers already display.

5.3 Structural and cultural barriers and enablers

The integration of digital technologies reveals a balance of structural and cultural barriers and enablers. T3 Structural Elaboration shows both morphostatic and morphogenetic outcomes. While platforms like Microsoft Teams and OneNote hold promise, inconsistent application across departments suggests morphostasis, as structural constraints persist. Archer's (2003) observation that "structural elaboration depends on how agents interact with new conditions" underscores this mixed outcome. Limited alignment between resources and training perpetuates barriers rather than enabling systemic transformation. As highlighted earlier, teachers' implicit biases, such as assumptions about which tools will or will not work for their learners, further compound structural barriers. For example, educators who consciously dismiss the potential of digital tools due to negative past experiences or lack of confidence may unconsciously reinforce these barriers, limiting the potential for technology to foster inclusive practices (Kim et al., 2013).

The main structural barriers are outdated and unreliable resources, representative of first-order limitations. Interactive whiteboards (IWBs), a common feature in many classrooms, often lacked updated licenses, significantly curtailing their functionality. Scherer et al (2019) speak to the rapid changes in technology requiring constant updating to allow for teachers to use their resources effectively. Frequent technical issues, such as recalibration problems, further frustrated teachers, dissuading them from relying on these tools consistently. Timotheou et al (2023) speak about change agility and agency in choosing the tools used in the classroom, to allow for greater teacher ownership of the process. They also mention how individual bias and competence will influence how the teacher approaches digital integration and copes with the barriers to integration. The inequality in student devices, with some learners having access to up-to-date tablets or laptops, while others struggled with inadequate equipment, created inequities that undermined the effectiveness of digital learning initiatives. Peruzzo and Allan (2022) support the need for creating seamless access to the technology being implemented. Without sufficient structural support, teachers' capacity to act independently and innovate is constrained, reinforcing the dynamic interplay between structure and agency as articulated by Archer (2003).

Professional development gaps, a second-order barrier, compounded these challenges. While training was offered, it often lacked relevance to teachers' specific needs. For instance, Mathematics teachers sought practical workshops on tools like Desmos, while creative subject teachers expressed interest in platforms like Canva. The absence of subject-specific training hindered their ability to apply digital tools meaningfully in their classrooms, limiting their confidence and enthusiasm. Peruzzo and Allan (2022) and Salas-Pilco et al (2022) affirm that digital tools need to be localised and contextually

relevant to be relatable for the learner and teacher. This is supported by Ghavifekr and Rosdy (2015), who state that teacher development needs both a technological and pedagogical approach to ensure relevance in the classroom.

On a systemic level, third-order barriers emerged through inconsistencies in policy communication and implementation. Teachers in the case study school mentioned that school leadership strongly advocated for technology integration, their vision often failed to translate into actionable guidance and implementation. Only 18% of teachers reported a clear understanding of expectations around digital tool use, leaving many uncertain and hesitant. This misalignment between institutional goals and practical realities underscored a significant structural disconnect. Ghavifekr and Rosdy (2015) highlight the importance of school management in the integration of technology, due predominantly to the influence in teacher perceptions, attitudes and school culture. We know from the literature that perceptions and attitudes are influenced by our bias, which can prevent us from engaging in new behaviours. Staats (2015) states that our bias can stop us from trying to use technology due to our perceptions on the usefulness of the technology.

Cultural attitudes further complicated technology integration, illustrating Archer's assertion that cultural change often lags behind structural adjustments. Generational divides played a role, with older teachers expressing apprehension towards digital tools, shaped by negative past experiences and limited exposure during their formative years in education. This was highlighted in Staats' (2015) work on bias in education, where teachers default to what they believe and what they expect. Where teachers have had a previously negative experience, they may approach similar experiences in the same way; older teachers may have had more negative experience and therefore resist technology. This scepticism from more experienced teachers stood in contrast to the enthusiasm displayed by younger teachers, who were more inclined to embrace innovation and experiment with new technologies, indicating emergent morphogenesis. Bias and cultural norms also influenced collaboration within departments. Some subject areas, such as Mathematics and the culture department, fostered stronger internal collaboration, creating pockets of progress; others remained resistant to change. This uneven cultural landscape highlighted the need for a more cohesive and supportive school-wide approach to technology integration (Salas-Pilco et al., 2022).

Despite these challenges, certain structural elements offered promise. Platforms like Microsoft Teams and OneNote stood out as tools with the potential to streamline communication and foster collaboration across departments. These digital resources, when effectively utilised, provided teachers with a structured way to share resources, coordinate activities and support each other in their professional development. Teachers spoke to the potential of the Microsoft platform for collaboration. And, used in conjunction with functional IWBs, had the possibility to shift how they teach. This is supported by Betcher and Lee (2009) who stated that IWBs allow teachers to teach in a manner they are comfortable with, while integrating additional technology into the classroom.

Cultural enablers also played a crucial role in overcoming barriers. A small but influential group of super-users emerged as informal advocates for technology integration. These educators not only demonstrated the potential of digital tools through their own practices, but also supported their colleagues by offering guidance and sharing resources. Their enthusiasm created a ripple effect, inspiring others to experiment with technology despite initial reservations. This advocacy hinted at

the possibility of broader cultural shifts. By fostering a sense of community and collaboration around technology, these super-users illustrated how cultural resistance could be challenged and gradually transformed into a shared commitment to innovation. Salas-Pilco et al. (2022) supports this as they found that culture influences what people learn, as well as how they learn.

5.4 Teacher agency in technology use

Teacher agency plays a pivotal role in navigating structural and cultural challenges. Archer (2000) emphasises that agency is contingent on reflexivity and prior experiences, which was evident in the case study. Across the school, individual teachers have demonstrated resilience and resourcefulness, using their agency to overcome systemic barriers and foster innovative practices. Some teachers displayed an enthusiasm for self-teaching, exploring tools such as interactive whiteboards (IWBs) to maintain lesson continuity despite frequent technical issues, and adopting platforms like Turnitin and Google Classroom to streamline assessment processes. However, biases in teacher agency must also be considered. As stated in Staats (2015), teachers' implicit attitudes, shaped by their own comfort levels with technology, may limit their willingness to experiment or seek out innovative tools. As Tsai and Chai (2012) note, such biases intersect with a lack of TPACK, further constraining agency and reinforcing resistance to change. Professional development that addresses these biases explicitly could empower teachers to engage more fully with digital technologies. Teachers who exhibited confidence in using tools like IWBs demonstrated their ability to engage in morphogenesis, reshaping both their practices and departmental norms (Archer & Morgan, 2020). Conversely, variability in agency highlights the uneven influence of structural constraints, as some teachers lacked the confidence or resources to integrate digital tools effectively.

The variability in teacher confidence and competence underscores persistent inequities. Approximately 76% of teachers indicated some level of effort towards inclusivity, yet many reported lacking a foundational understanding of critical frameworks like personalised learning, Universal Design for Learning (UDL), or differentiated instruction. Peruzzo and Allan (2022) speak to the need for a plurality in pedagogy and curricula, to allow for all learners to be supported and included. The gap in understanding regarding differentiated instruction in the case study school suggests that while individual efforts are commendable, they are often unstructured and unsupported by systematic training. Research indicates that comprehensive professional development is essential for inclusivity to be fully realised (Scherer et al., 2019; Timotheou et al., 2023). Training that encompasses accessible assessment tools, inclusive digital practices and UDL principles is particularly vital to bridging this gap to allow for teacher agency in implementing digital technologies.

The lack of structured training also influences perceptions of agency. Teachers who feel unsupported by institutional structures often experience reduced confidence in their ability to use digital technologies effectively. For example, while experienced educators displayed greater autonomy and adaptability, newer teachers were more cautious, constrained by limited training and perceived competence. This disparity aligns with Archer's (2003) theory of agency, which emphasises the influence of confidence on the adoption of new practices. Experienced teachers have shown a capacity to balance institutional expectations with personal pedagogical preferences, while newer teachers' hesitance highlights the need for more targeted guidance and mentorship. Enhancing teacher agency through continuous professional development could empower educators at all experience levels to integrate digital tools more effectively. This is also supported by Ghavifekr and Rosdy (2015), who

found that confidence, competence and belief were the biggest enablers or barriers to using technology in education.

Cultural factors also shape agency. Biases around age and experience have led some educators to internalise negative stereotypes about their technological abilities. Older teachers expressed apprehension based on past negative experiences, while younger colleagues tended to embrace new tools more readily. This generational divide reflects cultural norms and beliefs that influence attitudes towards technology and collaboration. The research shows that uptake in technology is less about age and more about bias; it is the perception that the technology may be difficult that creates the resistance to using it, rather than the age of the individual (Staats, 2015; Gonzalez et al, 2021; Cikara and Van Baval, 2014; Ross, 2008; Smith and Rock, 2018). Subject-specific cultures also play a role, with some departments fostering greater openness to experimentation and others adhering to more traditional practices.

The intersection of agency, structure and culture is critical in understanding how teachers navigate their roles. Teachers who actively leverage their agency are better equipped to adapt technology to meet diverse learner needs. This is supported by Timotheou et al. (2023) findings that the teachers' individual characteristics, bias and competence influence the uptake and success of digital technologies. However, the absence of coherent training on inclusive strategies limits the influence of these efforts. Teachers reported challenges in balancing institutional expectations for digital integration with their professional performance and well-being. For example, the lack of adequate training in assessment and evaluation tools has created tensions in the pursuit of personalised learning. These gaps highlight the need for schools to align their institutional goals with teachers' needs, providing structured support that respects and enhances agency. According to Scherer et al. (2019) teachers need to believe that the technology will be useful, and assist in creating time for them to focus on teaching more creatively and with less administrative duties.

Ultimately, fostering teacher agency requires a dual focus on professional development and systemic support. Schools must provide opportunities for educators to build their confidence and competence through targeted training and mentorship. By addressing both structural and cultural barriers, educators can be empowered to make informed decisions that align with their values and the diverse needs of their students. This approach will ensure that technology integration becomes not only a tool for innovation but also a pathway to inclusive and equitable education. Timotheou et al. (2023), Afzal et al. (2023) and Panesi et al. (2020) emphasise that teachers must be equipped with the skills to effectively use technology suited to their school's needs, enabling innovation, enhancing learner engagement, fostering collaboration and supporting personalised learning.

The findings highlighted the importance of a multi-faceted strategy to drive progress in digital integration and inclusive education. Central to this effort is addressing the interplay of structural and cultural barriers, teacher agency and the pervasive influence of bias. Structural challenges, including outdated infrastructure, inequitable access to devices and inconsistent technical support, remain significant obstacles to seamless digital integration. Tackling these barriers requires sustained investment in updated resources, ensuring all educators and learners have access to reliable technology. At the same time, cultural barriers, such as intergenerational divides and entrenched stereotypes about technology use, must be addressed through intentional efforts, to promote

collaboration across age groups and challenge limiting assumptions. Teacher agency stands as a pivotal factor in this process, underscoring the need to empower educators with tailored professional development opportunities that meet their specific needs and foster confidence in leveraging technology. Providing space for innovation, and recognising teachers as active agents of change, will enhance their ability to embrace new tools and inclusive practices. Adopting a holistic approach to aligning structure, culture, and agency allows for meaningful digital integration and the establishment of the foundations for truly inclusive, technology-rich educational environments where all learners can thrive.

5.5 Conclusion

This chapter examined how the interplay between structure, culture, training and teacher agency shapes the integration of digital technologies in the case study school, with implications for inclusive education. Applying Archer's (2020) morphogenetic model alongside Ertmer's (1999) first- and second-order barriers, and Tsai et al.'s (2012) third-order barriers, the findings demonstrate that while structural constraints such as outdated infrastructure, inconsistent training and unequal access to resources remain significant, cultural attitudes and teacher agency can either reinforce or challenge these limitations. Bias, both implicit and explicit, influences how teachers engage with technology. Cultural divides (particularly generational) and departmental disparities further compound this variability, indicating that attitudes towards digital tools are often shaped by past experiences and confidence levels rather than age alone.

Despite these challenges, signs of emergent morphogenesis are evident. A growing number of teachers, particularly super-users, are leveraging their agency to self-teach, mentor colleagues and promote digital practices. However, the inconsistent implementation of policies and limited alignment between professional development and classroom realities constrain more widespread transformation. To support sustainable change, schools must invest in targeted, relevant training that builds teacher confidence and competence, while also fostering collaborative cultures that challenge bias and support innovation. Bridging structural and cultural gaps through supportive leadership and professional development can empower teachers to become agents of inclusive, technology-enhanced learning.

Chapter 6: Conclusion

6.1 Introduction

This research sought to explore the intricate dynamics of digital technology integration and inclusive education, framed by the central question, "*How does teacher training and structure, culture and agency influence digital technology integration and inclusive education?"* By addressing this question, the study aimed to uncover the interconnected factors shaping digital technology use and inclusivity in schools. The secondary questions provided critical depth, focusing on identifying structural and cultural barriers and enablers, examining teachers' agency in adopting digital tools, and exploring how digital technology fosters inclusivity. Together, these questions offered a comprehensive perspective, revealing the multi-layered challenges and opportunities within the educational landscape.

6.2 Limitations

This study provides a glimpse into the digital technologies in use in South African schools and the influence on creating an inclusive learning environment. As the school where the case study took place is a well-resourced, independent school, it does not give a full picture of the influence of digital technologies in a school environment. Future studies should look to a variety of government and private schools with a range of resources from under-resourced to well-resourced.

The teachers who participated in this study have a positive attitude towards digital technologies and have experienced using some of the latest tools available. In future it would be beneficial to engage with teachers who have less positive attitudes towards digital technologies and have limited access to the tools. The school itself is very open to experimentation regarding the pedagogy of the teachers and has a supportive structure in place for teachers to experiment in. Future studies should look at schools where the structure is not as supportive and could constrain teachers' use of digital technology.

6.3 Teacher training, structure, culture, and agency in digital integration and inclusion

The research highlighted the significant role of teacher training in fostering digital technology integration and inclusive education. While in-service training has equipped many educators with both pedagogical and technical skills, the findings emphasize inconsistencies in the availability and relevance of professional development. Limited access to training tailored to specific needs, such as personalised learning and inclusive education frameworks like Universal Design for Learning (UDL), has hindered the broader adoption of inclusive practices. The survey results show that while many teachers acknowledge the expectation to use digital tools, a lack of consistent training and outdated technology prevents full adoption (Christiansen & Bertram, 2019). Over half of the senior school teachers had not received training on inclusive education or digital tools like interactive boards, and few had completed the free online training provided by the vendors of the school's technologies. Teacher surveys and interviews reveal varied levels of comfort and skill with digital technologies, with many teachers self-teaching or relying on limited training sessions. Teachers expressed frustration with the lack of training in personalised learning and inclusive education.

Despite these challenges, teachers reported using creative strategies to create inclusive environments, such as flexible learning methods, peer learning, and digital tools like Google Classroom and Kahoot. Teachers also noted the need for continuous professional development and collaboration across departments to effectively integrate digital tools. Interviews with subject heads further highlighted concerns about the inconsistent use of technology, ethical issues, and the financial and time constraints that influence the integration of digital tools in the classroom. While some subjects, like Physical Sciences and Mathematics, benefit greatly from digital tools for visualisation and data analysis, other departments reported a more cautious or underdeveloped use of technology. Subject heads stressed the need for a balanced approach, combining traditional teaching methods with technology. Additionally, the development of guidelines for ethical technology use and ongoing teacher training were identified as critical to successful digital integration in the future (Ghavifekr & Rosdy, 2015).

Structural factors play a critical role in shaping the integration of digital technologies in schools. Outdated infrastructure, inconsistent access to devices, and misaligned institutional policies emerge as persistent first-order barriers, reflecting the foundational constraints outlined by Ertmer (1999). Teachers frequently expressed frustration with inadequate technical support and obsolete technology, such as unlicensed interactive whiteboards that require constant recalibration. These first-order barriers inhibit the seamless integration of digital tools, creating a ripple effect that influences teaching efficacy and learner engagement.

According to Margaret Archer's Morphogenetic Model (2020), structure is not static but subject to change over time through the interplay between systemic influences and individual agency. The persistence of these structural barriers underscores the slow pace of systemic change within educational institutions. For example, while school leadership encourages digital integration, the absence of aligned policies and consistent infrastructure upgrades reflects a disconnect between intent and implementation. Structural enablers, such as leadership support and opportunities for cross- departmental collaboration, provide a glimpse into the potential for morphogenesis within the school environment. When leadership prioritises digital initiatives and fosters a culture of collaboration, teachers are better positioned to navigate existing constraints and leverage available resources creatively (Ghavifekr & Rosdy, 2015). These enablers highlight the dual role of structure in both constraining and facilitating change. For instance, while outdated infrastructure presents a significant challenge, the provision of collaborative tools like Microsoft Teams can mitigate some of these issues, enabling teachers to work around limitations and develop innovative practices.

However, as Archer (2003) emphasises, meaningful change requires not only individual agency but also a reconfiguration of structural conditions over time. This involves addressing the root causes of first-order barriers through strategic investments in infrastructure, equitable device distribution, and the alignment of policies with institutional goals (Ertmer, 1999). Without these systemic adjustments, the transformative potential of digital technologies remains constrained, perpetuating inequalities and limiting the capacity for inclusive education. The findings from this study underscore the importance of a dynamic approach to structural reform. By recognising the iterative relationship between structure and agency, educational institutions can move towards a more equitable and technology-enriched future, where systemic barriers are not merely navigated but dismantled and reimagined.

Margaret Archer's (2020) theory highlights the complex relationship between culture and agency,

suggesting that cultural norms and values can either constrain or enable individual actions (Archer & Morgan, 2020). Within the school context, cultural dynamics often reinforce existing hierarchies and attitudes towards technology. For example, departments with a tradition of valuing collaborative, technology-rich approaches are more likely to embrace digital tools, whereas those with a history of relying on traditional methods may resist change. This interplay between cultural context and individual agency illustrates how teachers' decisions to engage with technology are influenced by their social environment, not merely by personal preference or skill. In this research cultural influences shaped how digital tools were integrated into the classroom, acting as both barriers and enablers. Generational divides played a role, with differing levels of comfort and familiarity influencing teachers' engagement with technology. For instance, older educators frequently expressed less confidence in adopting new tools, citing challenges in adapting to rapid technological advancements and negative past experiences with poorly implemented systems. These apprehensions can stem from deep-seated biases and stereotypes, which equate age or length of experience with a resistance to change or diminished capability in using digital tools effectively.

Teacher agency emerged as a decisive factor in overcoming systemic barriers (Archer, 2003). Super-users, or teachers who are particularly skilled and enthusiastic about technology, have emerged as influential cultural agents showing a willingness to self-teach and explore new tools, adapting them creatively to meet learner needs. Examples included using interactive whiteboards for continuity and integrating platforms like Turnitin to streamline assessments. These efforts reflect how empowered teachers can redefine their roles as facilitators of inclusive, technology-enhanced learning. However, the research also highlights disparities in agency, with less confident teachers struggling to engage with digital tools effectively. This variability aligns with Archer's Morphogenetic Model, which emphasises the iterative relationship between systemic influences and individual agency (Archer & Morgan, 2020). Structural barriers, such as inadequate training and outdated technology, exacerbate these disparities, underscoring the need for a systemic approach to empowering all educators.

Using digital technologies in education is not going to change the education system but rather reinforce it (Furze, 2024); in other words digital technologies could make a good educational system better but will make a bad educational system worse. The advances in digital technologies, specifically AI, are going to challenge how the education system currently assesses knowledge instead of skills, as chatbots can provide the knowledge easily for learners (Furze, 2024). People, teachers, school management and government officials, need to drive the change in the education system using digital technologies to support the process. This research covers the change required within a single school where the leadership has influence over the structure, culture and ultimately the agency of individual teachers. The change required to the system is not covered.

This study underscores the complexities of integrating digital technology and fostering inclusivity in education. While teachers' agency and resourcefulness offer hope, structural and cultural barriers highlight the need for a multi-faceted, systemic approach. Addressing these challenges requires not only investment in infrastructure and professional development but also a cultural shift that empowers educators to innovate confidently. By aligning structure, culture, and agency, schools can create more inclusive and technology-rich learning environments.

6.4 Usefulness of social realism theory

This thesis reflects on the application of Margaret Archer's Morphogenetic Model, which allowed the researcher to understand the intricate relationship between structure, culture, and agency in the chosen school (Archer & Morgan, 2020). By employing this model, the researcher was able to explore how these elements interact and evolve, shedding light on the dynamics of digital integration and inclusivity. Social realism provided a robust theoretical framework for analysing the complexity of these processes. It offered a means to unpack how systemic structures, and cultural norms influence individual actions, while also allowing for the examination of how teachers' agency can instigate change within these parameters.

Through this lens, key theoretical insights emerged, particularly the iterative nature of change. The study illustrated how systemic influences and individual agency shape and reshape each other over time, creating cycles of adaptation and transformation. This perspective underscores the importance of recognising both the constraints and the opportunities presented by the educational context, offering a nuanced understanding of how meaningful change can be achieved.

6.5 Recommendations

These insights can inform strategies for promoting more inclusive learning environments through thoughtful integration of educational technology, addressing both cultural attitudes and individual agency among educators. For authentic learning to happen in this school given the teachers autonomy and access to digital technologies, here are tailored recommendations for school management, subject heads, and teachers to advance the implementation of digital technologies and foster inclusivity in education:

6.5.1 For the Department of Basic Education:

The Department of Basic Education (DBE) should prioritise the development and dissemination of clear, nationally aligned policies and frameworks that support the integration of digital technologies to enhance inclusive education. This includes establishing minimum standards for digital infrastructure, access to assistive technologies, and ongoing teacher professional development across all schools. Ensuring equitable allocation of resources and licenses across schools will reduce disparities and support consistent implementation nationwide. The DBE should also promote research-informed guidelines that encourage the use of emerging technologies, such as artificial intelligence and adaptive learning tools, tailored to diverse learner needs and curriculum requirements.

The DBE should invest in scalable, contextually relevant professional development programmes that build teacher capacity in digital pedagogy and inclusive practices, emphasising hands-on training and peer collaboration. Facilitating partnerships between schools, higher education institutions, technology providers, and community stakeholders can enhance resource sharing and innovation. To support sustained adoption, the DBE should embed digital literacy and inclusivity competencies within teacher education curricula and establish monitoring and evaluation mechanisms that track progress and inform policy refinement. By adopting a systemic, coordinated approach, the Department can empower schools to leverage technology effectively, ensuring all learners benefit from inclusive, technology-enhanced education.

6.5.2 For school management:

School management should prioritise structured support and resources to ensure that all teachers receive comprehensive training on digital tools, particularly for assessment and evaluation. Standardising the availability of digital resources and licences will address departmental inconsistencies. Additionally, clear school-wide guidelines for technology use should be developed to align with the school's educational goals and inclusivity standards, reducing disparities in its application.

Time allocation for collaboration and professional development is essential, allowing teachers to share digital strategies and inclusive practices across departments. This includes regular training sessions to keep teachers updated on the latest technologies and inclusive methods, such as assistive technologies. Financial constraints can be mitigated by prioritising key technologies that have the greatest influence on student learning, exploring phased implementations, or partnering with technology companies for cost-effective solutions. Encouraging a culture of experimentation and adaptation will support teachers in trialling new technologies without fear of failure. Management should foster innovation by recognising efforts to integrate technology and providing platforms for teachers to share their experiences, such as regular "show and tell" sessions.

6.5.3 For subject heads:

Subject heads play a crucial role in promoting the use of emerging technologies tailored to their disciplines. Encouraging the integration of tools like artificial intelligence or subject-specific applications can provide real-world contexts, such as using AI projects in Computer Science or digital sensors in Life Sciences to collect and analyse data. Involving students in the selection of digital tools ensures relevance and engagement, while authentic, subject-specific activities help link theoretical knowledge to practical scenarios. For example, Life Sciences teachers could encourage the use of digital tools in environmental experiments. Subject heads should also facilitate collaborations with external experts through guest lectures or virtual sessions, adding authenticity to the learning process.

Regular reflection and collaboration among teachers should be promoted, creating opportunities for cross-departmental sharing of strategies for digital inclusion. Supporting diverse teaching roles, where both teachers and learners take on multiple responsibilities, can deepen understanding and foster collaborative knowledge-building. Moreover, subject heads should ensure that assessment practices are comprehensive, encouraging formative assessments that integrate digital tools and reflect real-world learning experiences.

6.5.4 For teachers:

Teachers are encouraged to integrate authentic digital contexts into their lessons by using tools like AI and subject-specific applications that resonate with real-world scenarios. In Mathematics, for instance, AI-powered data analysis tools can help students explore patterns and trends. Developing hands-on activities that incorporate digital technologies further enhances active learning; for example, in Life Sciences, learners could use sensors to measure environmental variables, analyse data, and

present their findings. To enrich learning experiences, teachers should leverage external expertise through guest speakers or virtual collaborations. Encouraging students to adopt multiple roles—such as teaching their peers—promotes deeper understanding and diverse perspectives. Collaborative projects that span subjects, such as joint Geography and IT initiatives using mapping software, can demonstrate the interdisciplinary value of technology.

Teachers should engage learners as co-creators of knowledge, allowing them to contribute ideas on how digital tools can enhance their learning. Reflection and critical thinking can be fostered through regular sessions where learners analyse their use of digital tools and present their insights to peers, promoting a culture of reflection and shared learning. Guidance in using new digital tools should be structured, with a gradual release of responsibility as learners gain confidence. Continuous, purposeful assessment using digital tools is crucial, focusing on frequent feedback and alignment with curricular goals. This approach ensures that assessments measure learners' engagement with both the subject matter and the technology.

Implementing digital technologies to improve inclusion in the school will require coordinated efforts between management, subject heads, and teachers. By aligning resources, professional development, and practices with the school's educational and inclusivity goals, the school can foster a more inclusive learning environment where technology enhances teaching and learning for all learners. Both subject heads and teachers can create a structured yet flexible environment where digital technologies are used not only to enhance learning but also to promote inclusivity. These practices will enable learners to engage more deeply with the curriculum, providing real-world applications and opportunities to reflect, collaborate, and take ownership of their learning journey and digital literacy.

6.6 Audience

This thesis is particularly relevant for teachers and school leaders, offering actionable insights to enhance digital integration and inclusive education. By addressing practical challenges and providing evidence-based recommendations, it serves as a guide for creating more equitable and technology-rich learning environments.

Policymakers will also find value in this work, as it highlights the systemic barriers that hinder effective digital adoption and inclusive practices. The findings underscore the need for policies that prioritise equitable access to resources, coherent institutional frameworks, and ongoing professional development, ensuring that all learners and teachers are supported.

For researchers, this thesis provides a valuable resource for exploring the intersection of technology, inclusion, and teacher agency. By applying social realism as a theoretical framework, it contributes to a deeper understanding of how structure, culture, and agency shape educational practices. It lays the groundwork for further inquiry into strategies for empowering teachers and fostering inclusive education through technology.

6.7 Personal reflections

In reflecting on this study, the integration of technology and inclusive teaching practices is heavily influenced by the agency of the teacher. Within the context I studied, the institution provided both the structure and the tools necessary for teachers to create inclusive learning environments using digital technologies. While some teachers successfully leveraged these resources to create inclusive classrooms, the majority struggled to fully utilise the digital technologies available to them.

This reluctance can largely be attributed to teacher beliefs, established practices, and varying levels of competence. Many of the teachers I engaged with were hesitant to implement new digital technologies in their classrooms, fearing that they might appear incompetent in front of their students. This fear of inadequacy was a recurrent theme in the data. Despite these challenges, it became evident that with the right support, particularly through structured training and ongoing professional development, teachers were able to increase their comfort levels with digital tools. Teachers demonstrated a genuine willingness to learn and engage with new technologies, but constraints such as limited time and the lack of confidence in their abilities often held them back.

The data suggests that these barriers are not insurmountable. When provided with adequate support, training, and encouragement, teachers can overcome their apprehensions and experiment with new digital tools as they emerge. This highlights a key area where educational institutions can improve, by providing not only the technological tools but also the consistent, targeted support necessary to foster teachers' confidence and competence in using these tools effectively.

6.8 Closing

As this study draws to a close, the influence of digital technologies on teaching and learning is still an evolving area. The pace of technological advancement, especially in the field of AI, is accelerating rapidly, presenting both challenges and opportunities for educators. In the classroom, teachers are faced with the need to continuously adapt to these changes, and understanding how and why they implement, or don't implement, these technologies become crucial. The way teachers adopt or reject these new technologies will significantly shape how effectively they can support inclusive learning environments, particularly for learners requiring personalised support.

The findings of this study suggest that digital technologies, when implemented thoughtfully, have the potential to provide opportunities that have historically been denied to many learners, especially those with disabilities or from disadvantaged backgrounds. However, there is a clear need for more comprehensive teacher training and support systems to ensure that teachers are equipped to use these technologies to their full potential.

Looking to the future, there is great promise in digital technologies' ability to change education, especially in creating personalised learning paths for students. Yet, the rapid pace of technological change brings with it ethical and practical considerations. It is essential to address these challenges,

particularly with respect to equity in access to technology and the preparedness of educators. If digital tools are to fulfil their potential in creating inclusive education, a concerted effort must be made to ensure that both teachers and students are adequately supported in navigating this new landscape. Future research should look at how digital technologies in being integrated into teacher training programmes along with their application in personalising learning.

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Appendix 1: Ethical Clearance

SCHOOL OF EDUCATION

Dr. Joanne Hardman
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EDNREC20231204

M. Anderson

HTHMEG001

7 December 2023

Re Ethical clearance

I am pleased to inform you that ethical clearance has been granted by the School of Education Ethics Review Committee of the Faculty of Humanities for your academic project: Exploring the Integration of Digital Technology in Teacher Training for Enhanced Inclusion

Regards

Signed by candidate

ASSOCIATE PROFESSOR JOANNE HARDMAN

Appendix 2: Interview and Survey Questions

Survey Questions

Inclusive Education Training:

a) What topics related to inclusive education were covered in your teacher training program?
b) Can you provide specific examples of strategies or concepts related to inclusive education that you learned during your training?

Digital Technology Integration:

a) Were you provided with training on the use of digital technologies in your teaching practice during your teacher training?
b) What specific digital tools or technologies were introduced or emphasized in your training?

Pedagogical Approaches:

a) How were you taught to adapt your teaching methods to be more inclusive of diverse learners, including those with special needs?
b) Were there discussions or training on Universal Design for Learning (UDL) or differentiated instruction?

Assessment and Evaluation:

a) Did your training cover how to assess and evaluate student progress in an inclusive classroom, especially when digital technologies are involved?
b) Were you introduced to accessible assessment methods or tools?

Collaboration and Teamwork:

a) Did your training emphasize the importance of collaborating with other professionals, such as special education teachers or therapists, to support inclusive education?
b) Were there any discussions on using digital tools for collaboration and communication with other educators or specialists?

Legal and Ethical Considerations:

a) Were you informed about the legal and ethical aspects of inclusive education, such as Individualized Education Plans (IEPs) and students' rights?
b) How were digital technologies integrated into discussions about legal and ethical considerations?

Personalised Learning:

a) Did your training address the concept of personalised learning, and if so, how does it relate to inclusive education and digital technology?
b) Were there any examples of technology being used to support personalised learning?

Professional Development:

a) Have you received any professional development opportunities related to inclusion and digital technology since completing your initial teacher training?
b) How have you continued to build your skills and knowledge in these areas?

Challenges and Successes:

a) Can you share any specific challenges you've faced in implementing inclusive practices with the use of digital technology in your classroom?
b) Are there any success stories or positive outcomes resulting from your training in this area?

Future Needs:

a) What areas of inclusive education and digital technology do you feel you need further training or support in?
b) How can teacher training programs better prepare educators for inclusive teaching with technology?

Institutional Structure:

a) How would you describe the overall structure of your current school or educational institution in terms of supporting teaching practices?
b) Can you provide examples of how the institutional structure impacts your daily teaching routine and classroom activities?

Institutional Culture:

a) From your perspective, what is the prevailing culture within your school? How does this culture influence teaching approaches and interactions with colleagues?
b) How do you see the institutional culture promoting or hindering collaborative initiatives among teachers?

Agency and Decision-Making:

a) To what extent do you feel you have agency in making decisions about your teaching methods, curriculum, and classroom activities?
b) Can you share examples of how you exercise agency in adapting your teaching to meet the needs of your students?

Alignment with Institutional Goals:

a) How well do you think your teaching practices align with the goals and priorities set by the school or educational institution?
b) In what ways do you contribute to achieving the broader goals and mission of your institution through your teaching?

Professional Development and Autonomy:

a) How does your school support your professional development, and to what extent are you given autonomy in choosing your professional development paths?
b) Can you share examples of how you've taken the initiative to pursue professional growth within the context of your school's structure?

Collaboration and Networking:

a) How does your school facilitate collaboration among teachers? Are there structures in place that encourage knowledge sharing and teamwork?
b) In what ways do you engage with your colleagues to enhance your teaching practices?

Cultural Responsiveness:

a) How does the cultural context of your school influence your teaching strategies and approaches?
b) Can you provide examples of how you incorporate diverse cultural perspectives into your teaching practices?

Adapting to Change:

a) How has the institutional structure supported or posed challenges in adapting to changes in education, such as new technologies or teaching methodologies?
b) Can you share instances where you successfully navigated changes in the educational landscape within your institution?

Inclusive Practices:

a) To what extent does the institutional structure facilitate the implementation of inclusive teaching practices?
b) How do you exercise agency in creating an inclusive learning environment for students with diverse needs?

Reflection and Feedback:

a) How does the institutional structure support ongoing reflection on your teaching practices?

b) Can you share examples of how feedback mechanisms within your school contribute to your professional growth?

Challenges and Opportunities:

a) What challenges, if any, do you face in balancing institutional expectations with your own teaching philosophy and methods?
b) How do you see opportunities for professional growth and personal agency within the current institutional context?

Interview questions

Inclusion/exclusion and access

1. What is inclusive education, and how do you define it within your teaching practice?
2. What does equitable access to education mean to you, and how do you ensure it in your classroom?
3. In your experience, what are the primary causes of exclusion from education, and how do they manifest?
4. Based on your experience, what are the current challenges related to inclusion that teachers commonly encounter in their practice?

Technology

1. Could you explain your understanding of educational technology and its role in modern teaching practices?
2. In what ways do you currently see technology being utilised in your school to support teaching and learning?
3. How do you envision the future role of technology evolving within your department, and what steps are being taken to adapt to emerging trends or advancements?
4. Are there any specific areas or topics within your subject domain where you believe technology integration could have the most significant impact or benefit?
5. From your viewpoint, what are the key challenges and barriers associated with implementing educational technology?
6. As a subject head, what is your stance on the integration of technology in the teaching and learning process within your department?
7. How do you ensure that the use of technology within your department aligns with broader educational goals, curriculum requirements, and assessment standards?

Structure

1. What teacher development opportunities are available to you, and how do you engage with them to enhance your teaching skills?
2. How do you assess the level of digital competency among teachers in your department, and what strategies are in place to address any gaps or challenges?

Culture

1. What are the prevailing attitudes and perceptions among teachers regarding the integration of educational technology into schools?
2. What measures or initiatives have you implemented to promote the effective use of technology among teachers within your department?

Agency

1. In your opinion, what are the potential benefits and limitations of using technology in teaching your subject area?
2. What influence do you have, as a teacher and subject head, in choosing to implement educational technology?
3. How do your own experiences, attitudes, beliefs impact this implementation for yourself and for others?

Appendix 3: Information and Consent

In-Service Teacher Information letter

Dear Ms_____,

A case study of digital technologies and inclusive education

I am a researcher working in the School of Education at the University of Cape Town. I would like to ask your permission to carry out research on the use of digital technologies in your classroom. My research aims to explore the use of digital technologies and the impact in inclusive learning environments.

While there is a growing body of research on digital technologies, there is a gap in how they can be used to create inclusion in the classroom. My assumption is that digital technologies are not currently widespread due to the lack of exposure and/or training teacher have regarding the use and application of digital technologies.

Data collection will be in the form of classroom observation on XX at XX time. We will observe teaching and learners engagement in the class, by making notes and audio-recording. We hope to interview you at the end of the observation period for about 30 minutes. This will offer an opportunity to pursue any areas of interest that may have arisen during observation. We would also like to collect learners' digital portfolios if created.

Participation is voluntary and the confidentiality of the school, as well as the teachers and learners, is guaranteed. The school will be given a pseudonym (different name) and pseudonyms will be used for all participants in the writing up of the research. You may withdraw permission for conducting the research at any time.

Please fill in the form to indicate your consent for the research. You are welcome to ask any questions regarding this research by telephone or email me: 0833979159 or hthmeg001@myuct.ac.za

Yours sincerely,

Meghan Anderson

Example Teacher Consent form

A case study of digital technologies and inclusive education

I consent to	**YES**	**NO**
1.Being observed in the classroom		
2.Being audio-recorded working in the classroom		
3.Assisting in the collection of class work		

4. Being interviewed		
5. Audio- recording of the interview		

I understand that my participation is voluntary, and that confidentiality will be maintained. I can withdraw my participation at any time.

Name: (Print)

(Signature)

(Date)