An Exploration of Learning Environments, Focusing on the Role of Information and Communication Technology: A Case Study of New Zealand Seventh-day Adventist Secondary Schools

Ryan Gounder

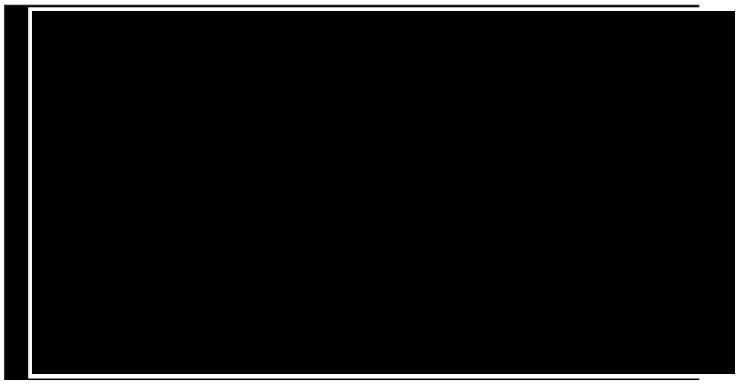
School of Education and Science
Avondale University

Thesis submitted in fulfilment of the requirements for the degree
Doctor of Philosophy

Supervisor Dr Peter Beamish

STATEMENT OF ORIGINAL AUTHORSHIP

I declare that the work contained in this thesis has not been submitted previously for a degree or diploma at this institution, an Australian or overseas university or any other institution of higher education. To the best of my knowledge and belief, this thesis contains no material previously published or written by another person except where due reference is made.

Signed 

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ABSTRACT

This study investigates the Learning Environment of New Zealand Seventh-day Adventist (NZ SDA) secondary schools, particularly focusing on the role of ICT (Information and Communication Technology), from the perspective of the students, teachers and principals in these schools. The focus of this study stems from the established role of ICT in 21st-century education and the desire to provide students in NZ SDA secondary schools with quality learning experiences.

Three research questions underpin this study. Firstly, what is the nature of the Learning Environment in NZ SDA schools? Secondly, what role and impact does ICT play in supporting the Learning Environment? Finally, what needs to be established at the system, school, and classroom level to enhance the Learning Environment in NZ SDA schools, with a particular emphasis on the role of ICT? A mixed-method approach was utilised to gather quantitative and qualitative data from the respective students, teachers and principals through surveys, observations, and interviews.

This study found that students and teachers generally have a positive perception of the Learning Environment in their schools. Students particularly valued the Learning Environment as they felt that it equipped them with skills for success beyond school. However, participants also indicated that while ICT plays a significant role in the Learning Environment in NZ SDA schools, it is frequently underutilised. Often, ICT is used as a direct substitute for traditional 'pen and paper' methods rather than being employed innovatively to augment and redefine pedagogy. In addition, this study also found that there is a digital divide and varying levels of proficiency in effectively utilising ICT. This disparity often led to poor learning experiences for students.

Both students and faculty reported a strong desire for effective and innovative utilisation of ICT within the school Learning Environment. Participants indicated that when ICT is used creatively to redefine pedagogy, students find the education process more engaging, and it generates a greater degree of collaboration. It also enables the customisation of learning experiences. This study concludes that NZ SDA schools will most likely benefit from

targeted professional development, infrastructure upgrades, and innovative teaching practices that use ICT to transform the Learning Environment to maximise the benefits of ICT.

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Abbreviations

AE	Adventist Education
AI	Artificial Intelligence
AT	Assistive Technology
BYOD	Bring Your Own Device
CERI	(OECD's) Centre for Education Research and Innovation
COL	Community of Learning
ICT	Information and Communication Technology
ILE	Innovative Learning Environment
IITL	Integration of ICT in Teaching and Learning
IoT	Internet Of Things
MOE	Ministry of Education
NEG	National Education Goal
NISS	New ICT Supporting School Framework
NZ	New Zealand
NZC	New Zealand Curriculum
OECD	Organisation for Economic Co-operation and Development
PD	Professional Development
QLE	Quality Learning Environment
QT	Quality Teaching Framework (also referred to as Quality Teaching Model)
SAMR	Substitution, Augmentation, Modification, and Redefinition
SDA	Seventh-day Adventist
SNUP	School Network Upgrade Project
TAM	Technology Acceptance Model
TOE	Technology Organisation Environment
TPACK	Technological Pedagogical Content Knowledge
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
UTAUT	Unified Theory of Acceptance and Use of Technology
WSNUP	Wireless School Network Upgrade Project

Chapter 1 Introduction

1.1. Research Orientation

Education plays an important role in an increasingly changing and digitised society (Cohen et al., 2019; Reynolds, 2022; Worsley, 2022). Within schools, the Learning Environments that are created have a significant impact on developing informed, creative, and versatile individuals capable of thriving in, and contributing to, a fast-changing society (Imms & Mahat, 2022; OECD, 2021g). Information and Communication Technology (ICT) is increasingly becoming an indispensable tool that can positively impact pedagogy within Learning Environments (Imms & Mahat, 2022; OECD, 2023e). The use of ICT can broaden access to knowledge (Szymkowiak et al., 2021), and facilitate a more personalised learning experience (Golden, 2023; Imms, 2018) that produces more engaged learners with higher successful course completion rates (Archambault et al., 2022a; Namatherdhala et al., 2022; Ulum, 2022).

The way that ICT is used for pedagogical purposes continues to evolve. For example, Artificial Intelligence (AI) and machine learning can adaptively shape learning content to suit individual learning styles (Cope et al., 2021; Hwang & Chien, 2022), which contributes to improved student engagement and statistically better academic outcomes (Holmes et al., 2023; Sarker et al., 2019). Furthermore, as a result of the COVID-19 pandemic experience (Harris et al., 2024) and the subsequent push towards remote and hybrid learning, ICT has been found to be essential in enabling the continuity of education (Adedoyin & Soykan, 2023; Gajdzik, 2022)

The role of ICT within Learning Environments continues to require scholarly attention (Clausen et al., 2023; Hallström, 2022; Stolpe et al.,, 2024; Zhang, Chen, et al., 2022). For example, Divjak et al. (2022) identified a substantial void in our understanding of the holistic impact of ICT on different facets of learning. It focused on larger subsets of learning processes associated with using ICT to ascertain long-term effects. Their research established a need for longitudinal studies. Similarly, Greenhow et al. (2022b) highlight the need for empirical studies that examine how ICT can facilitate active learning, critical thinking, and creativity within Learning Environments. Tlili et al. (2022) argue that while

initial research indicates the potential for ICT to create more inclusive and accessible Learning Environments, many areas remain under-explored. For example, Xia et al. (2022) found a significant gap in our understanding of optimally utilising ICT to improve learning outcomes and student engagement. This study seeks to help close the identified gaps by investigating the role of ICT in the Learning Environment of secondary schools within the New Zealand (NZ) Seventh-day Adventist (SDA) education system.

1.1 Rationale

The primary rationale for this study is to provide NZ SDA schools with information that can assist in delivering a quality education system. Aware of the growing body of literature on the importance of ICT in education (Bernacki et al., 2020; Wicks & Paulus Jr, 2022), SDA school leaders in New Zealand have strongly supported integrating ICT into learning (Rosalie McFarlane, personal communication, September 15, 2020). They recognise its significant role in enhancing the quality of education within SDA schools. However, to date, no studies have been undertaken within schools in the NZ SDA education system to investigate school Learning Environments and pedagogies incorporating ICT.

Furthermore, personal communication with NZ SDA school administrators highlighted that using ICT is one of the most significant areas of interest for school leaders. This was because of substantial frustrations with obstacles that hinder the effective integration of ICT in classrooms (Rosalie McFarlane, personal communication, September 15, 2020). The main frustrations mentioned were “finance”, “a lack of capacity”, “being risk averse”, “staffing issues”, “not enough support and professional development”, and a general lack of confidence in their ability and what they described as “shoddy and unreliable” infrastructure (Rosalie McFarlane, personal communication, September 15, 2020). In addition, the school principals stated that teachers in the SDA school system in NZ tend to use traditional pedagogical strategies, which is commonly referred to as the ‘sage on the stage’ method (Bobis et al., 2020; King, 1993; McWilliam, 2009) as opposed to being facilitators who use ICT to transform pedagogical practice. NZ SDA school leaders widely felt that the school Learning Environments needed to be investigated, and strategies developed to assist the NZ SDA education system in moving forward.

1.2 The Research Context

In academic research, especially qualitative research, it is essential for a researcher to understand the context of their chosen topic and provide readers with background information on their scholarly quest (Creswell, 2014; Creswell & Miller, 2000). This section is a documentation of this introspection. It expands on the foundational elements that resulted in the subsequent research presented in this thesis.

Most inquiries begin with a "why", a seed of curiosity (Sinek, 2011). Some of the reasons for undertaking this study have already been discussed in the introduction. While many studies aim for quantitative objectivity (Eisner, 1992; Resnik, 2001), the qualitative perspectives and experiences of the researcher can play a significant role in shaping the investigation (Creswell, 2014). Sections 1.4 and 1.5 provides a personal narrative, shedding light on the background and the path that enabled this study. These sections discuss the processes, inspirations, and serendipitous events that helped form the central ideas for this study, and highlight that academic pursuits are often deeply connected with personal interests and curiosity (Bleiker et al., 2019; Piaget, 2006; Strandburg, 2005).

1.3 Personal Background and Journey to Beginning this Study

In 2015, I was put in the position of ICT facilitator at a bi-annual retreat of all NZ SDA teachers. While I am a qualified and practising teacher, my role within the NZ SDA school system for the prior two decades had been in ICT infrastructure development and technical support, with a minor teaching role. In short, I view myself as an IT person. I have designed and implemented many ICT networks for schools from scratch, often being the person in the background (i.e., in a server room, usually working after hours), who ensures that infrastructure that supports learning is working. However, becoming the ICT facilitator at the retreat took me out of the 'server room' (my comfort zone) and into closer contact with teachers in supporting their ICT-incorporated pedagogy.

My initial reaction to being made the ICT facilitator was, "Why me?" That was quickly answered with the response that there was no one else. Every other technical IT person within the NZ SDA school system had resigned. The other reason was that I was perceived

to know a lot about ICT, however, my knowledge mainly consisted of the technical aspects of the ICT networks I have set up. This would be of little use to teachers who are not interested in technical aspects but focus on pedagogy.

Finding myself in unfamiliar territory, I went into 'discovery-inventory-audit mode', which literature suggests is the best practice for an ICT professional (West, 2021). I began by asking basic questions about their ICT infrastructure, student numbers, year levels, pedagogical strategies involving ICT, and professional development around ICT, to name a few. I asked those questions to better understand the teachers' needs and challenges. However, this resulted in our ICT session quickly turning into what could be described as a therapy session.

The teacher's responses indicated that within NZ SDA schools, there was a general division into three groups: the Microsoft, Apple and Google 'camps'. Each 'camp' viewed the others as inferior or wished everyone was on 'their' platform. It seemed like there was a 'technology war' between the major technology vendors, an area that has a large body of literature (Arthur, 2014; Moore & Tambini, 2018; Webber, 2012). Some teachers took out laptops that were years old but looked brand new because they had barely used them, as they did not perceive ICT as useful in the classroom (an area that has been the focus of research overseas (Falloon, 2020; Mercader & Gairín, 2020)). Some teachers had free email accounts (*Yahoo*, *Gmail*, *Hotmail*, *Xtra*, etc.) as their official school email addresses. Poor infrastructure and tech support, as opposed to pedagogy, was the major discussion point.

I inadvertently became a facilitator of the debate amongst the teachers on the philosophy of education and technology. They were debating whether technology should drive pedagogy, or pedagogy should drive technology, and whether there is a viable middle ground between the two. Upon reflection and research, I discovered that the topic has been the subject of extensive research. For example, Fawns (2022b, p. 711) succinctly points out that:

> *"'Pedagogy first' has become a mantra for educators, supported by the metaphor of the 'pedagogical horse' driving the 'technological cart' [however] putting technology first or last separates it from pedagogy [which makes one] susceptible to technological or pedagogical determinism."*

The debates on *Technology Dichotomy* and *Pedagogy Dichotomy* and the various forms of *Determinism* and *Solutionism*, all have extensive bodies of literature to support them (Nolan et al., 2022; Oliver, 2011; Sharma, 2022; Vest, 2023). Despite this, the teachers involved in the discussion found it challenging to reach a consensus. This struggle highlights the difficulty of reconciling philosophy with practical teaching strategies and using ICT effectively in specific Learning Environments.

During the meeting, specific inefficiencies and exciting areas of research were identified by the teachers. Of particular interest to me was that there was extraordinarily little coordination between schools, i.e., the teachers in one school were unaware of what teachers in other schools were doing. There was no cloud-based shared Content Management System, which resulted in the 'wheel' being repeatedly reinvented. Everyone agreed that the effective integration of ICT into their Learning Environments was essential to facilitating better student learning outcomes. At the same time, however, a pervasive sense of despair hung in the air, seemingly born from identified issues within how 'the system' was set up as opposed to the people (teachers). William Deming studied this phenomenon (Deming, 2018), and subsequently called it *Deming's Theory*, or the '95/5 rule', where he theorised that 95% of the variation in performance of an organisation is caused by the 'system itself', and only 5% by its 'people' (Koch, 2011; Rasch, 2004).

There was consensus and much concern among the participants that their schools were lagging behind other schools in integrating ICT into their Learning Environments. Narratives were shared of parents choosing to send their children to more 'ICT focused' schools, resulting in decreased enrolments in NZ SDA schools resulting in a downward spiral. In short, the need for effective ICT integration appeared to be about keeping up with digitisation trends and ensuring the NZ SDA schools remain relevant and appealing to current and prospective students and their parents.

1.4 Crystallising the Idea for this Study

Three months after the above-described meeting with teachers, I had a conversation about the use of ICT in classrooms with a recently retired principal. He suggested that I conduct a formal investigation into this area. Over the following months, it felt that everyone I met

encouraged me to examine ICT usage more formally within SDA schools. Eventually, I realised that my combined experience in technical and teaching roles uniquely positioned me to carry out this study.

In trying to formalise and crystallise this study's scope and research question(s), I began with what interests me. I have a natural tendency to focus on hardware and software because I enjoy deploying ICT systems for schools. I have successfully designed and implemented numerous ICT networks for schools and supported the end users, i.e., students and teachers. These school networks that I have designed have worked extremely well and have been commended as models to follow. Therefore, given my strength in this area, I initially focused on ICT infrastructure, particularly decision-making processes that lead to the implementation of infrastructure, how that infrastructure is maintained, and its impact on pedagogy. In hindsight, that was because it was within my comfort zone. The literature also suggests that stable, fit-for-purpose ICT infrastructure is a prerequisite to a quality Learning Environment (Barrett et al., 2019; Commission et al., 2023; Gil-Flores et al., 2017; Kumar, 2008; Kundu et al., 2020; Lomos et al., 2023a).

In discussing my passion in this area, senior administrators within the NZ SDA school system shared their vision that SDA schools in NZ should be interlinked to the extent that they come under a single community of learning. This was because most NZ SDA schools are small (around a hundred students), which makes resourcing them with specialist teachers challenging. There was much discussion of the efficiencies and economies of scale that would be achieved by having a single community of learning, and senior administrators saw ICT as necessary in bridging the physical divide between schools.

Reviewing the literature in this area revealed a history of interlinking small/rural public and Māori schools using ICT in NZ. One such initiative is the *Kaupapa Ara Whakawhiti Matauranga* (KAWM) project, which was a total immersion Māori school (Waiti, 2005), in which numerous local groups were established rapidly, eventually being recognised under the umbrella term *The Virtual Learning Network* (VLN). By 2010, more than 50% of New Zealand's Area and Secondary Schools had incorporated online learning. These interconnected school systems were designed to cater to the requirements of small rural schools, providing them with the means to deliver their curriculum by utilising ICT (Whalley

& Barbour, 2020). In contrast, SDA schools had not yet adopted this technology. This highlights a gap between the potential applications of ICT in enhancing pedagogy and the actual implementation within SDA schools.

Interlinking geographically distant schools requires specialised infrastructure (Huang et al., 2019), and customised solutions (Cakir et al., 2009), which is why my thesis proposal drafts were largely technical. Given my technical background and familiarity bias (Chien et al., 2023), I reasoned that to have a quality 21st-century Learning Environment (see González-Pérez & Ramírez-Montoya, 2022), first and foremost, fit-for-purpose ICT infrastructure needs to be procured, implemented and effectively managed (West, 2013). Therefore, I reasoned that if one were to do a study, the first thing one should look at is the ICT infrastructure and how that may be implemented and managed efficiently so teachers and students have this foundational element (ICT infrastructure) in place that supports innovative pedagogy. Administrators within the NZ SDA school system were not overly enthusiastic (and some were dismissive) about a study with a big focus on infrastructure. They were far more interested in pedagogy.

After thoroughly examining a wide range of literature, including meta-studies on education and technology (Blut & Wang, 2020; Castro & Tumibay, 2021; Garzón et al., 2020), an informal pilot study was conducted which led to multiple changes in the research direction. This decision was influenced by literature indicating that while ICT infrastructure is an essential component in 21st-century Learning Environments (Barrett et al., 2019; Webber et al., 2022), it represents only one aspect of an innovative 21-st century learning environment (Ali et al., 2020; Kundu et al., 2020; Lu et al., 2015; Newhouse, 2012).

The Ministry of Education (MOE) strives to use cultural metaphors in New Zealand. One such metaphor is “weaving”, which has significant meaning for the Māori and Pasifika communities, who have been plagued by academic underachievement (Kenny, 2022; OAG, 2023). These communities also make up a substantial percentage of the SDA student population. As illustrated in Figure 1.1, the New Zealand Ministry of Education has developed a graphic on ‘effective teaching for powerful learning’ (MOE, 2016). It illustrates the different strands that, when woven together, can result in effective teaching and effective learning.



Figure 1.1 Effective Teaching for Powerful Learning (From MOE, 2016)

In its 2016 report, the Ministry of Education adds that effective teaching is not just about developing ICT infrastructure. It is about how it can be used to support successful teaching methods, increase student outcomes and create a Learning Environment that is future-focused (MOE, 2016). What caught my attention was the strand "Innovative Learning Environments" illustrated on the top right-hand side of Figure 1.1.

With the above illustration in mind, I subsequently came across a press release by Nikki Kay, the Associate Education Minister of New Zealand at the time, announcing a "21st-century Learning Reference Group," which was tasked with providing the New Zealand government with advice on how to change the education system to make it fit-for-purpose for the future (Scoop, 2013). Fourteen prominent intellectuals and industry professionals worked for over a year and produced a report. Their report mentioned "Learning Environments" nineteen

times, and one of their ten recommendations was to "Create future-focused Learning Environments" (Amos et al., 2014, p. 5). Furthermore, they also prominently highlighted the role of digital technology and made specific recommendations about the need for the government to make digital infrastructure investments (Amos et al., 2014).

In addition to the literature, my supervisors, academics, and education professionals whom I consulted, nudged me toward exploring the "Learning Environments" instead of just the 'technical aspects of ICT' within the schools. With this background in mind, this study seeks to investigate ICT's role in enhancing Learning Environments in NZ SDA schools.

1.5 Research Questions

After much discussion, consultation and revision, the following research questions were created to form the foundation of this study.

1. What is the nature of the Learning Environment in NZ SDA schools?
2. What role and impact does ICT play in supporting the Learning Environment?
3. What needs to be established at the system, school, and classroom levels to enhance the Learning Environment in NZ SDA schools; with a particular emphasis on the role of ICT?

A Learning Environment is defined as a place where students learn (Peterson, 1990). It can include physical spaces such as classrooms, other school and home learning spaces, as well as virtual spaces (Imms & Mahat, 2022) like Google Classroom (Beaumont, 2018) and Moodle (Alier et al., 2010).

1.6 Benefits of this Study

A major benefit of this study is that it will inform the SDA education system in New Zealand about the aspects of the current state of its Learning Environments, a 'stock-take', so to speak. Secondly, it is well-established that ICT plays a significant role in 21st-century learning (Chai et al., 2018; Clausen et al., 2023). Hence, this enquiry can be beneficial to the NZ SDA education system as it seeks to provide research data relating to actual ICT use in

schools. This is an area identified as a priority by leaders within the NZ SDA education system, and also by the New Zealand Government (Stringer et al., 2023). In addition, this study hopes to benefit students and teachers by investigating ways to use ICT to transform Learning Environments and increase student outcomes. 'Outcomes' include results in assessments (Montenegro & Jankowski, 2020) and factors that include student engagement with learning, well-being, and creativity which are components of what is considered 21st-century skills (Davis, 2023; González-Pérez & Ramírez-Montoya, 2022; van Laar et al., 2017).

Chapter 2 Literature Review

2.1 Introduction

Within educational practice, the effective integration of ICT has become an increasingly important focus (Commission et al., 2023; OECD, 2023a; Timotheou et al., 2023). This is primarily due to the rapid advancement of digital technology (Adedoyin & Soykan, 2023; Batdı et al., 2021; Kang, 2021), and its increasing presence in the classroom (Imms & Mahat, 2022). Such a shift has the potential to positively change the way educators practice pedagogy including how, when and where students engage with content (Chan & Tsi, 2023; Gentile et al., 2023; Holmes et al., 2023).

The NZ SDA school system's mission is to be at the forefront of innovative educational practice (CAS, 2021; LAC, 2021). In addition, these schools have unique educational objectives, pedagogical philosophies, and dedication to holistic development (Knight, 2001; Nielsen, 2023). Hence, understanding how the Learning Environment function, and the relationship between ICT and Learning Environments in NZ SDA schools, forms the core of this literature review. Through a systematic exploration, this literature review seeks to provide an in-depth examination of ICT integration within the NZ SDA Learning Environment framework.

2.1.1 Literature Review Structure

There are many accepted ways to write a literature review (Denney & Tewksbury, 2013; Fink, 2019; Paul & Criado, 2020). A systematic process had to be undertaken to understand, analyse, synthesise, and identify gaps in this large body of literature associated with this study. The framework used for this review is a modified version of a strategy recommended by Simon Sinek, a popular author and specialist in strategic communication (Sinek, 2009, 2011). Sinek (2011) recommends starting with the question *why?* when tackling large and complex subjects, and then proceeding with the *how?* and *what?* This model, known as the 'Golden Circle', emphasises the importance of starting with a well-defined purpose to communicate complex ideas effectively. It has been successfully used in the past, demonstrating its effectiveness in streamlining communication and decision-making

processes (Straker & Nusem, 2019). Utilising the framework, the following three questions will frame this literature review:

1. **Why** use ICT within the Learning Environments in SDA schools? (Focus: This section will discuss why ICT should be used to improve the distinctive Special Character and Learning Environments of SDA schools).

2. ***How*** do we create a quality Learning Environment that incorporates ICT? (Focus: This section will investigate the paradigms of ICT-enhanced pedagogy and relevant theoretical models that explain how one creates a quality Learning Environment that incorporates ICT).

3. ***What*** are the possible results when ICT is used in a quality Learning Environment? (Focus: Centred around the New ICT Supporting School (NISS) Framework, this section will discuss the outcomes of ICT integration when used effectively in a quality Learning Environment).

In short, this literature review aims to provide relevant existing knowledge, identify gaps, establish connections, and lay the groundwork for an informed inquiry into ICT's role and potential within the Learning Environments in NZ SDA schools.

2.2 Why Use ICT Within Learning Environments in NZ SDA Schools?

With ICT being an inescapable reality (Kosimov & Ruziboyeva, 2022), equipping students with digital literacy and ICT skills is important (Bejaković & Mrnjavac, 2020; MOE, 2023; OECD, 2022a; Timotheou et al., 2023). However, as pedagogy evolves as a result of advancements in ICT (Mishra et al., 2021) and its increasing ubiquity (OECD, 2023h), understanding how ICT fits into rapidly changing Learning Environments is widely considered an important factor in improving student learning outcomes (Haleem et al., 2022; OECD, 2021g; Sánchez-Cruzado et al., 2021).

Using ICT within Learning Environments is no longer regarded as just one of the 'tools' in an educator's arsenal (Clasborn, 2017; Utecht, 2011). It is now often described as

"omnipresent" (Gabriel et al., 2022, p. 85) and "… the only way to dramatically expand access to knowledge [globally] …" (OECD, 2015, p. 4), making it an important enabler in advancing pedagogy to meet current and future needs (OECD, 2020a; Szymkowiak et al., 2021).

The shift of New Zealand into a knowledge economy is a major part of this transformation (Greenaway-McGrevy et al., 2020). This shift primarily rests on Learning Environments' capacity to efficiently enable the "knowledge" that is fundamental to a knowledge-driven economy (Choong & Leung, 2021; Starkey & Wood, 2021b). In other words, it depends on schools' capacity to impart the knowledge and abilities required for success in a knowledge-based economy.

2.2.1 Why: ICT Advances are Impacting Society

The literature overwhelmingly supports the view that the benefits of ICT in education are self-evident (Page Jeffery, 2022) and that ICT-related skills and competencies will be indispensable (Matt et al., 2022; OECD, 2021c), or, are already essential across a wide spectrum of industries (World Bank, 2022). This necessity is driven by the digital transformation continually reshaping the global job market (World Economic Forum, 2020; Zimmermann & Brandtner, 2022). The increasing importance and widespread proliferation of ICT are apparent at the individual (Lehner, 2018), national (Foster & Azmeh, 2020; Golden, 2023), and global (Hoffman, 2019) levels, as well as its integration into nearly all facets of daily life (Ross & Maynard, 2021). For instance, since 2015, the ICT sector in New Zealand has grown 77% faster than the country's entire GDP, contributing $7.5 billion to the country's GDP (Beehive, 2022). In a similar vein, ICT-related business is now the third-largest industry in Australia (Accenture, 2021). During the COVID-19 pandemic crisis, 60,000 new jobs were created, indicating potential for significant development compared to other sectors (Accenture, 2021).

In this time of rapid technological progression, '21st-century learning' and 'life-long learning' have surfaced as focal concepts in contemporary research and scholarly discourse (Kim et al., 2019; Rawas, 2024; Silber-Varod et al., 2019; Tohani & Aulia, 2022). These phrases embody our collective efforts to equip students for a future marked by unceasing rapid

change (Field, 2000; Thornhill-Miller et al., 2023; Thwe & Kalman, 2024). However, while 'life-long learning' is self-explanatory, '21st-century learning' is ambiguous because it has been used in an increasing number of contexts by educators, policymakers, and researchers to describe a wide range of skills, competencies, and instructional strategies that are important for contemporary learners (Erstad & Siddiq, 2023; Low et al., 2023; Seevaratnam et al., 2023; Varas et al., 2023). To better understand '21st-century learning', the driving forces behind technological advances impacting societies, with a flow on impact to schools, will now be discussed.

2.2.1.1 Driving Force 1: The Rate of Technological Change in Education

A recently published book by Halder and Saha (2023) describes how technology has changed education. They describe what was once thought to be state-of-the-art inventions, chalkboards and fountain pens have been surpassed by more contemporary technologies (Halder & Saha, 2023; Saettler, 2004). Today, advanced technologies, including Artificial Intelligence (Bozkurt et al., 2023), Augmented Reality (Buchner et al., 2022), and the Metaverse (Dahan et al., 2022), have the potential to reshape pedagogy. Effective technology integration is often driven by innovative ideas on how to use the technologies, as opposed to the technologies themselves (Granic, 2022; Watson, 2006).

Education is an iterative process that requires continuous adaptation to meet the shifting needs, challenges, and opportunities (OECD, 2023b, 2023e). As illustrated in Table 2.1, based on Majumdar (2015), there has been a noticeable paradigm shift in how schooling is perceived and conducted. Since traditional didactic approaches have given way to more participatory (Bobis et al., 2020), immersive (Beck, 2019), and exploratory strategies (Espino-Díaz et al., 2020).

This transformation encompasses the roles of educators and learners (Davis, 2023). In addition, it influences how learning content is delivered (French et al., 2020), and even how the physical Learning Environments are structured (ILETC, 2023; Morris & Imms, 2023b). Table 2.1 provides a comparison of these shifts, highlighting the move from static, rigid systems to flexible, collaborative formats better suited to contemporary educational demands. These changes reflect a move towards pedagogy that is adaptive and designed to encourage

greater collaboration. They are equipped to facilitate the wide range of learning styles and needs of increasingly varied student populations (Majumdar, 2015).

Table 2-1 Paradigm Shift in Schools (Adapted from Majumdar, 2015)

Teachers Roles	
FROM	**TO**
Transmitter of Knowledge	Guide & Facilitator of Knowledge
Controller of Learning	Creator of Learning Environment
Always the Expert	Collaborator & Co-learner
Learning to use ICT	Using ICT to Improve Learning
Didactive & Expository	Interactive, Experiential & Exploratory
Students Roles	
FROM	**TO**
Passive Learner	Active Learner
Reproducer of Knowledge	Producer of Knowledge
Dependent Learner	Autonomous Learner
Solitary Learner	Collaborative Learner
Solely Learning Content	Learning to Learn, Think, Create & Communicate
Curriculum & Delivery	
FROM	**TO**
Memorising Facts	Inquiry-Based
Artificial Teaching Exercises	Authentic Learning
Rigid Delivery (Fixed Time & Space)	Open & Flexible Delivery (Any Time & Anywhere)
Single Path Progression	Multi-Path Progression
Changes in Media	
FROM	**TO**
Single Sense Stimulation	Multi-Sensory Stimulation
Single Media Application	Multimedia Application
Delivery of Information	Exchange of Information
Monologue Communication	Dialogue & Collaborative
Analogue Resources	Digital Resources
Physical Learning Environment	
FROM	**TO**
Small Classrooms	Larger and Open Plan
Fixed Furniture	Flexible

The roles of educators have evolved from transmitters of knowledge to collaborative guides (Werth & Williams, 2023), while students' roles have changed from being passive users of knowledge to being active, self-directed learners (Barker & McDonald, 2022; McLean & Attardi, 2023). This evolution spans the roles of educators (Cohen, 2021), the curriculum framework (Tomlinson & Jarvis, 2023), the incorporation of different types of digital technology, and the design of the physical learning spaces (Imms, 2018). It signifies the education sector's commitment to nurturing an intellectually stimulating, interactive, and

ICT-enhanced learning experience (Prestridge et al., 2023). These changes, while challenging, provide unprecedented opportunities for growth, innovation, and the cultivation of future-ready learners (Imms & Mahat, 2022; Majumdar, 2015; OECD, 2023e; Varas et al., 2023).

2.2.1.2 Driving Force 2: Learning Environments that are Increasingly Digitised

Globally, the accelerating pace of digitalisation is a reality that is becoming increasingly significant and unavoidable (Kagermann, 2015; Uchidiuno et al., 2019). The education sector is one where this transformation is becoming significantly visible (Cornali & Cavaletto, 2021). Such transformation, driven by the rapid advancement of digital technology (Tajudeen et al., 2021), has been metaphorically likened to a fast-paced tsunami, making changes in almost every facet of life (Crittenden et al., 2019).

One example of this paradigm shift is illustrated by a recurring question that students often ask, “Is there an app for that?” (Chiong & Shuler, 2010; Douglas et al., 2012; Larkin, 2013). Such a question reflects the evolution of education undergoing a paradigm shift, where students expect that learning content is delivered in a digitised format (Frank, 2021; Noskova et al., 2021; Ydyrysbayev et al., 2022).

A specific example of this digital transition is the widespread use of applications, such as *Blinkist*, a tool summarising non-fiction text into palatable fifteen-minute reads, providing a faster way to consume large volumes of text (Klein & Hughes, 2020). *Blinkist* is part of a contemporary trend in Learning Environments and aims to streamline and improve the learning process, making learning quick and convenient (Welbers et al., 2019; Zamborova & Klimova, 2023). Widely categorised as educational software, these applications integrate interactive elements and succinct summaries to help users learn while under time constraints (Montazami et al., 2022). The rise of such online learning spaces can be attributed to a blend of technological advancements and a societal push towards making learning more accessible. This is achieved by designing software that can accommodate different learning styles (Chelkowski et al., 2019), and cater to time-constrained learners (Chen et al., 2021). Transformations such as this are described as something more than just a short term trend but one that is steadily becoming an enduring norm (Papadakis, 2021).

Such digital shifts also impact how educators teach and engage with students within classrooms (Hall & Lundin, 2024; Wijnen et al., 2021; Willermark & Islind, 2022). Traditional offline software is often used in combination with online cloud-based software where both complement each other in enabling learning (Stringer et al., 2023; Varas et al., 2023). These technologies encourage active participation (Alemayehu & Chen, 2023), real-time feedback (Hidayah & Indriani, 2021), and personalised learning experiences (Kem, 2022; Wang, 2024). Online spaces, for example, Moodle (Gamage et al., 2022), Google Classroom (Gupta & Pathania, 2021), and Microsoft 365 (Aires et al., 2021) are increasingly common, enabling students to access learning material, submit assignments, and conveniently engage in discussions (ILETC, 2023). Such ICT integration occurs to meet the needs of this contemporary 'tech-savvy' generation known as 'digital natives' (Janschitz & Penker, 2022), and supports a more interactive and engaging learning atmosphere (OECD, 2023e).

2.2.1.3 Driving Force 3: ICT is an Enabler of 21st-Century Skills

Scholars use many terms and phrases such as 'teaching for the 21st- century,' 'future-focused learning', 'futures education', and 'lifelong learning', all of which converge on a similar interpretation (Agrawal & Mittal, 2018; Dudaitė & Dačiulytė, 2021; Sinnema et al., 2020). They see these concepts as preparing students for a time of unparalleled change (Tight, 2021), a future where continuous and rapid technological advancement is reshaping our social relationships, workplaces, and everyday life (Ghory & Ghafory, 2021; Tabroni et al., 2022).

Students must keep up with this changing environment and acquire abilities that were previously not required (Danao, 2024; Erstad & Siddiq, 2023). These skills include adaptability (Muñoz et al., 2022; Taylor et al., 2021), innovative problem solvers (Joyner & Ward, 2022), ability to demonstrate creativity (Kong, 2019), collaboration and connection-building (Forsyth et al., 2020), and effective adjustment to rapid changes in a data-driven society (OECD, 2021e, 2021f; Purwanto et al., 2023; Treffinger et al., 2023).

Many 21st-century learning paradigms place particular emphasis on Learning Environments to help students develop these skills (González-Pérez & Ramírez-Montoya, 2022), namely

the 4Cs: critical thinking, creative thinking, collaboration, and communication skills (Kembara et al., 2019; Thornhill-Miller et al., 2023; Weng, Cui, et al., 2022). In our fast-paced and rapidly changing society, these competencies are increasingly viewed as essential for individuals to cope with new challenges (Commission et al., 2019; Funke et al., 2018; Morris, 2019). Therefore, Learning Environments must actively facilitate the development of these skills (Geng et al., 2019; Sasson et al., 2022; Wells & O'Riordan, 2021).

ICT provides many educational software applications and online learning spaces that facilitate the development of 21st-century skills, such as critical thinking and problem-solving among students (Bernacki et al., 2020; Lai & Bower, 2019). Through digital software applications, which includes online discussion forums (Onyema, Deborah, et al., 2019), virtual simulations (Radianti et al., 2020), and interactive learning systems, ICT encourages students to engage in analysis, synthesise new ideas, and develop 21st-century stills (Al-Fraihat et al., 2020). Contemporary literature emphasises that just the possession of information or knowledge is inadequate in the 21st-century (OECD, 2022a, 2023a; World Bank, 2022). As Alec Bourne points out:

> *"It is possible to store the mind with a million facts and still be entirely uneducated." (Alec Bourne in Snyder & Snyder, 2008, p. 90)*

Unlike in the past, when memorisation and recall of information in formal assessments helped students to successfully graduate, and improve employment prospects, today, this is no longer the case (Deming & Noray, 2020; Goulart et al., 2022). Instead, current Learning Environments and workplaces require learners to be critical thinkers and problem solvers (Calma & Davies, 2021; Lyu & Liu, 2021).

The current understanding of the necessary skills and competencies for learners to thrive has changed dramatically (Geisinger, 2016; Oberländer et al., 2020; OECD, 2022a; Sorensen et al., 2021). Because of rapid ICT advancements, a re-framing of education to facilitate the development of a special set of 'skills', commonly known as 21st-century skills, is needed (Chalkiadaki, 2018; World Economic Forum, 2020). 21st-century skills cover a wide spectrum of competencies (Bellanca & Brandt, 2010; Thornhill-Miller et al., 2023). These skills encompass the abilities learners need to succeed in an ICT-based, complex and increasingly changing society (Camp, 2001; Erstad & Siddiq, 2023; Varas et al., 2023).

A defining aspect of 21st-century skills is focusing on higher-order cognitive competencies or better learning outcomes (Gupta & Mishra, 2021), rather than traditional academic knowledge (Kwangmuang et al., 2021a; Rios et al., 2020). These skills involve advanced thinking and communication capabilities (González-Pérez & Ramírez-Montoya, 2022), as well as values, ethics, and attitudes that encourage active global citizenship and an understanding of the varied global socio-cultural sensibilities (Care et al., 2018; Erstad & Siddiq, 2023; Varas et al., 2023). In essence, 21st-century skills represent a paradigm shift in education (Rios et al., 2020), prioritising what learners know and how they apply it in complex and real-world scenarios (Erstad & Siddiq, 2023; Reaves, 2019). It is indicative of an age where adaptability, creativity, collaboration, and other soft skills are considered more important than having knowledge (Dede, 2009; Lamri & Lubart, 2023; P21, 2018; Thornhill-Miller et al., 2023; Tight, 2021).

2.2.1.3.1 Which 21st-Century Skills?

A fundamental question that many, including the *New Zealand Ministry of Education*, have been asking is: What knowledge, skills, competencies, and capabilities do students need to participate in a 21st-century New Zealand society meaningfully (Erstad & Siddiq, 2023; Lamri & Lubart, 2023; MOE, 2022c; van Lamoen, 2022). There are two essential requisites to answering this question when discussing "21st-century skills". The first is that although "21st-century skills" may sound modern, many of the skills described are not "new", but, "newly important", mainly because of the increased interconnectedness, emergent demands of rapid innovation, and the exponential increase in knowledge (Dilekçi & Karatay, 2023; Drake & Reid, 2018).

Secondly, although there are many different lists of what are considered '21st-century skills' (Thornhill-Miller et al., 2023; van Laar et al., 2020; World Economic Forum, 2023), these generally fall under the wide definition of 'soft skills' (Almeida & Morais, 2023; Escolà-Gascón & Gallifa, 2022). Most of these lists of soft skills are similar (McGuinness, 2018), or, as Dede (2010, p. 11) puts it, "… generally consistent with each other." It is beyond the scope of this literature review to conduct an in-depth discussion of every specific skill. Instead, general types of skills that are typically called "21st-century skills" will be discussed.

Figure 2.1 illustrates the top skills on the rise, as identified by the World Economic Forum in 2023. The most important skills on the list are cognitive soft skills, encompassing critical thinking, problem-solving, and collaboration (World Economic Forum, 2023). This emphasis on cognitive soft skills is widely agreed to be important (Erstad & Siddiq, 2023; Lamri & Lubart, 2023; Marin-Zapata et al., 2022; Wicks & Paulus Jr, 2022). Such widespread agreement highlights the importance that cognitive soft skills play in equipping individuals for the demands and challenges of the 21st-century (Weng, Cui, et al., 2022).



Figure 2.1 Top 10 Skills on the Rise (From the World Economic Forum, 2023)

There has been a shift in terminology from "skills" to "competencies" (McGuinness, 2018; Society & OECD, 2018) and "fluencies" (Crockett, 2018) in describing 21st-century requirements. The Australian and New Zealand curricula include some of these 21st-century skills/competencies. The terminology "competencies" as opposed to "skills" has been a significant part of the New Zealand Curriculum, which defines it as "… capabilities for living and lifelong learning." Hipkins (2014) writes that 'capabilities' are embedded within 'competency'. The five *Key Competencies* in the New Zealand Curriculum are: Thinking, Using Language, Symbols and Text, Managing Self, Relating to Others, and Participating and Contributing (MOE, 2007). The Australian Curriculum has seven *General Capabilities* (Gilbert, 2019), which, like the New Zealand Curriculum, aims to equip Australians with

what is required "… to live and work optimally in the twenty-first century." (Curriculum, 2018). These are: Literacy, Numeracy, ICT Capability, Critical and Creative Thinking, Personal and Social Capability, Ethical Understanding, and Intercultural Understanding (Curriculum, 2018).

Comparing the New Zealand *Key Competencies* and the Australian *General Capabilities* reveals overlaps (McGuinness, 2018). For example, lifelong learning is mentioned explicitly in the aims of the New Zealand Curriculum *Key Competencies* as 'a vision about students as 'lifelong learners'' (MOE, 2014). In a similar fashion, the *General Capabilities* also mention 'lifelong learning' in the context of intercultural understanding (Curriculum, 2018).

The overarching objective in both New Zealand's *Key Competencies* and Australia's *General Capabilities* appears to be the preparation of students for a globalised world, which emphasises adaptability, continuous upskilling, and cultural awareness (Gilbert, 2019; MOE, 2014; Reinsfield, 2020). In this regard, the New Zealand model places a distinct emphasis on equipping learners with attributes that ensure adaptability in both personal and societal domains (Lourie, 2020). Conversely, the Australian *General Capabilities* emphasises the integration of intercultural understanding, probably as a reflection of both Australia's multicultural demography, and its position as the dominant entity within the Asia-Pacific region (McCandless et al., 2020). While both curricula address the imperatives of critical thinking and problem-solving, the Australian *General Capabilities* goes into more detail on ethics, personal and social responsibility (Gilbert, 2019; Moss et al., 2019). Such distinctions highlight the national and regional priorities and societal aspirations embedded within each framework, yet it is unmistakable that both converge on the importance of producing individuals capable of coping within a fast-paced society and an uncertain globalised and increasingly digitised future (MOE, 2022c; Redmond et al., 2021).

The workforce of today requires individuals who are knowledgeable in their respective areas and also have soft skills such as versatility, emotional intelligence, and the capability to work collaboratively in different environments (OECD, 2023b). The literature emphasises that to keep pace with the rapidly changing employment market (World Bank, 2022) and increasing ICT use, schools worldwide need to undergo significant transformations (Closs et al., 2022; OECD, 2023b). These changes are important in equipping learners with a balanced mix of

academic knowledge and soft skills (Sancho-Cantus et al., 2023; Thornhill-Miller et al., 2023) so that they are well-prepared to effectively participate and thrive in the 21st-century (Sorensen et al., 2021). As such, contemporary education is increasingly about moulding well-rounded individuals, who can adapt, innovate, and thrive (Chalkiadaki, 2018; OECD, 2021e, 2021g).

2.2.2 Why: ICT use in the Learning Environment Enables Innovative Pedagogy

Within learning environments that are changing due to advances in ICT, it is well-established that ICT can enable innovative pedagogy (Kilag et al., 2023; Mishra et al., 2024; Newhouse, 2017; Puentedura, 2006). Modern Learning Environments, sometimes referred to as Innovative Learning Environments or Flexible Learning Environments, often entail an underlying philosophy of collaboration (MOE, 2022a), and often include student-centred learning experiences (Silva et al., 2021) supported by the effective use of ICT (Benade, 2020; Coleman & Luton, 2021; Imms et al., 2016b; Newhouse, 2008a; Spivakovsky et al., 2019). In addition, a salient feature of these environments is the incorporation of flexible spatial configurations that can accommodate a wide range of learning activities and meet varied student needs (Dovey & Fisher, 2014; Hill, 2006; Valtonen et al., 2021). These may encompass open-plan areas, breakout areas, and collaborative zones, all created to encourage interaction, teamwork, and autonomous learning (Dovey & Fisher, 2014; Fisher, 2021b; ILETC, 2023; Nai, 2022).

A fit-for-purpose ICT infrastructure is an essential component of modern, innovative Learning Environments (Bocconi et al., 2012; Groff, 2013; Lockwood & Cornell, 2013; Lu et al., 2015). Governing bodies have outlined minimum technical requirements to ensure these environments are adequately supported (Koellmer, 2016; MOE, 2020c). These requirements include high-speed internet connectivity, wireless networks, and a variety of digital devices like laptops and tablets (Cheung et al., 2021; Garlinska et al., 2023; Trafera, 2021). The purpose of such infrastructure is to provide students and educators with high-speed and efficient access to a wide range of software and hardware, to improve student learning (Kundu et al., 2020; Mendoza et al., 2023). Also, the increasing use of a Bring Your Own Device (BYOD) policy is usually a feature of such Learning Environments (Cui, 2020; Page Jeffery, 2022). This enables students to bring their personal devices to school, subsequently

facilitating access to digital resources and collaboration with peers, resulting in learning experiences using a device that they are familiar with and that they can take outside of school to continue learning activities (Demchenko et al., 2022; Nuhoğlu Kibar et al., 2020; Shafik, 2024).

Incorporating a variety of collaboration and communication tools is yet another feature of modern and innovative Learning Environments (Mishra et al., 2021; Singh & Miah, 2020; Snoussi, 2019). Specific examples of tools for course management include Learning Management Systems (LMS), such as *Moodle* and *Google Classroom* (Gudkova et al., 2021; Gupta & Pathania, 2021). Cloud-based applications, like *Google Workspace* and *Microsoft SharePoint*, support group projects, while video conferencing tools like *Google Meet* and *Zoom* enable virtual interactions (Camilleri & Camilleri, 2022; Thavi et al., 2024). Furthermore, digital portfolios, created with tools such as *Canva*, are utilised for efficiently presenting student work (Hinchcliff & Mehmet, 2023; Saputra et al., 2022).

The effective use of such digital technology can result in a more interactive and engaging learning experience that prepares students for the technologically-driven workforce (AlphaBeta, 2022; Fiore et al., 2018). Such technology is designed to increase collaboration and boost creativity (Soboleva & Karavaev, 2020). It also enables students to work effectively, both independently and as part of a team (Camilleri & Camilleri, 2022; Janneck & Bleek, 2023). In addition, it provides opportunities for personalised learning experiences (Amro & Borup, 2019; Muydinovich, 2022), which is increasingly enabled in modern Learning Environments through adaptive learning software. Specific examples include online assessment tools that provide instant feedback, combined with data analytics that personalise the learning experience (Alamri et al., 2021; Caspari-Sadeghi, 2023; Muñoz et al., 2022; Regan & Jesse, 2019).

These technologies enable educators to tailor instruction to individual student needs, monitor their progress, and provide timely feedback, thereby developing learner autonomy (Topping et al., 2022; Tsai, 2021). In modern Learning Environments, there is a significant emphasis on digital citizenship and cyber safety (Pashby et al., 2020; Prasetiyo et al., 2023), which aims to instil essential digital literacy skills and ethical online behaviour (Byers et al., 2018; Imms, 2018). By providing students with the knowledge to use the cybersphere safely and by

promoting responsible online behaviour, these efforts address the increasingly important issues of cybersecurity, safety, and privacy (Alderman et al., 2024; Khan et al., 2022; Kritzinger, 2024; Rahman et al., 2020).

While specific implementation of modern innovative Learning Environments may vary across different schools (Osborne, 2016; Sasson et al., 2022), the common objective is to maximise the benefits of ICT to create engaging, collaborative, and student-centred learning experiences that meet current pedagogical demands while also remaining future-focused (Frelin & Grannäs, 2021; Imms et al., 2016a; Page & Davis, 2023). This highlights the changing nature of modern innovative learning environments that aim to better serve both student needs and the requirements of the workforce.

2.2.3 Why: ICT Allows for Flexible Blended Learning

Another significant reason to use ICT in education is how it enables flexible blended learning models (Crawford, 2017; Topping et al., 2022). Blended learning is another aspect of modern Learning Environments, where traditional teaching methods amalgamate with digital technologies (Cao, 2023; Singh, 2021; Topping et al., 2022). This provides teachers with options to integrate online resources, multimedia content, and software such as learning management systems into their pedagogical repertoire, thereby increasing student engagement (Brown et al., 2022), and catering to individual learning needs (Li & Wang, 2022; Lin et al., 2020).

On the twelfth of March 2020, the World Health Organisation (WHO) declared COVID-19 a Global Pandemic (Ciotti et al., 2020). Extended lockdowns followed this (Wu He et al., 2021), mandated by many governments, including Australia and New Zealand, to reduce mortality caused by the COVID-19 pandemic (W. He et al., 2021; Karlinsky & Kobak, 2021; Kung et al., 2021). During the lockdowns, education was prioritised, which speaks volumes to the "… idea that education is indeed not just a human right, but a basic need, an essential activity for children and that it had to be protected and continued" (Reimers, 2022a, p. 468).

Consequently, this global health crisis exerted immense pressure on educational institutions to swiftly transition to remote learning (OECD, 2021g). Schools struggled with maintaining

the continuity of learning in the face of significant challenges (OECD, 2021g). This required a rapid and unprecedented emergency shift to online software applications such as *Google Classroom* and *Moodle* and remote teaching methods via video conferencing using *Zoom, Microsoft Teams, Google Meet,* etc (Contrino et al., 2024; OECD, 2023e). This highlighted the adaptability and resilience of the education sector in the face of adversity (OECD, 2020b; Schleicher, 2020). This resulted in the invention of new terms to describe education, such as, "… cybergogy, pandemiagogy, and even panicagogy" (Sembiring, 2022, p. 36).

Before the COVID-19 pandemic, the digital transformation of education was well underway (Balkin & Sonnevend, 2016; Balyer & Öz, 2018; Voronin et al., 2020), evidenced by billions of dollars in government investment in infrastructure and technical support (MOE, 2021b; NSW, 2020). Many schools within Australia and New Zealand were already on a rocky digitisation process (Adel & Dayan, 2021; Ewing & Cooper, 2021; Wells, 2018). They were either already Bring Your Own Device (BYOD) schools or provided students with computers (Adhikari et al., 2021; Fletcher & Everatt, 2021; Page Jeffery, 2022; Thomas et al., 2021). Furthermore, teachers and students were continuing an ongoing, and leisurely process (Beckman et al., 2018) of developing the skills to utilise ICT effectively (Starkey & Wood, 2021a). While ICT devices were being used in schools daily, this usage primarily occurred in classrooms and mainly in a face-to-face pedagogical modality, where ICT was primarily being used optionally as a 'tool' under the supervision of teachers to improve learning, with varying degrees of effectiveness (Adel & Dayan, 2021; Falcon, 2012; Voogt et al., 2013).

Extended lockdowns, as a result of the COVID-19 pandemic, forced schools to rapidly shift their pedagogical modality from face-to-face to online within a matter of weeks (OECD, 2020b; Thorn & Vincent-Lancrin, 2022). This sudden change introduced numerous significant challenges (Agasisti et al., 2023; Sharp et al., 2020; Stracke et al., 2022), including exposing the competence of teachers' ICT skills (Adedoyin & Soykan, 2023; Scully et al., 2021), and highlighting issues related to the availability of ICT devices and connectivity (Mishra et al., 2021; Rajab et al., 2020), which exposed an embarrassing digital divide, even in economically developed nations such as Australia and New Zealand (Adhikari et al., 2017; Aotearoa, 2022; Corkin et al., 2022; Drane et al., 2020).

Despite these challenges, many schools globally, including those in Australia and New Zealand, reported that both teachers and students were generally successful in adapting to remote education (Domina et al., 2021; Ewing & Cooper, 2021; Page, Charteris, et al., 2021; Schleicher, 2020). However, this remains an under-researched area and a subject matter that the New Zealand Ministry of Education administrators are keen to investigate further (Gounder, 2022).

Despite the ending of lockdowns and the reopening of brick-and-mortar schools, many assert that education has been fundamentally transformed (OECD, 2023b; Yong Zhao & Jim Watterston, 2021). This shift is primarily attributed to the widespread recognition that remote online education is viable and effective (Miller et al., 2021) for primary, secondary school-levels (Christian et al., 2021; Iglesias-Pradas et al., 2021; Zhao & Watterston, 2021) and also in higher education (Guppy et al., 2022; Neuwirth et al., 2021). However, challenges still exist, some of which include the ICT literacy of teachers (Yeşilyurt & Vezne, 2023), attitudes towards technology (Li & Yu, 2022; Marín & Castaneda, 2023), and availability of technical support (Aissaoui, 2021; Cavus et al., 2021), to name a few.

Despite these challenges, significant and urgent efforts are underway by international organisations, such as the OECD, to increase the effectiveness of remote and hybrid Learning Environments (Cook & Holley, 2022; OECD, 2021f; Raes et al., 2020). At the macro level, governments and international organisations such as the OECD are keen on using ICT to increase organisational efficiency (OECD, 2021g), and its positive ripple effects on the global economy (Choong & Leung, 2021; OECD, 2020a, 2022a). Similarly, at a more localised level, institutions, such as schools, are adopting parallel strategies (Syahrani, 2021; Williamson, 2018; Zaluchu, 2020). This includes Adventist Education and the SDA school system in NZ (Franco et al., 2021; Iversen, 2020), as they move to use ICT to help establish remote and hybrid Learning Environments that can be possibly used to facilitate quality learning.

2.2.4 Why: Summary

There are three categories of good reasons why we use ICT in Learning Environments in NZ SDA schools. Firstly, the use of ICT helps students develop 21st-century skills. The

integration of ICT in learning environments helps prepare students for the demands of modern society and employment, where digital literacy is becoming essential. By effectively incorporating ICT into the Learning Environments, students can develop essential 21st-century skills, such as critical thinking, problem-solving, collaboration, and adaptability. Secondly, the use of ICT within Learning Environments enables pedagogical practices that enable access to otherwise unavailable resources, thereby providing opportunities for personalised and self-directed learning that can extend learners. This shift towards an ICT-centric education model reflects societal trends of increasing digitisation to increase efficiency. Thirdly, using ICT enables the most flexible and blended learning methods. These are just some compelling reasons for using ICT within the Learning Environments of NZ SDA schools.

2.3 How Do We Establish a Quality Learning Environment That Incorporates ICT?

Having discussed why we should investigate school Learning Environments that incorporate ICT, we need to turn our attention to how we go about establishing these quality Learning Environments. The use of ICT has become integral in Innovative Learning Environments (OECD, 2018a, 2023b), providing new models of teaching and learning such and flipped and blended learning (Han et al., 2024; Müller et al., 2023) that have the potential to significantly improve the outcomes in traditional classrooms (Mishra et al., 2021; MOE, 2022a; Sasson et al., 2022). A quality Learning Environment is one that effectively utilises ICT to develop cognitive development (Firth et al., 2019; Wang et al., 2022). It also prepares students for success by providing a means to acquire ICT-related skills (Varas et al., 2023).

Much of the literature on innovative Learning Environments views ICT as a positive transformative force (Benavides et al., 2020; Chugh et al., 2023; ILETC, 2023) in reshaping the methodology and philosophy underpinning effective pedagogy (OECD, 2022b; Rahmonovich et al., 2023). The focus has shifted from questioning the value of integration of ICT in Learning Environments to exploring how to best utilise ICT to optimise learning outcomes, spark creativity and improve critical thinking (OECD, 2023c, 2023f). This can prepare learners for an increasingly digitalised and uncertain future (Bicalho et al., 2023; Fraillon et al., 2020; OECD, 2021c; Voogt et al., 2013).

The definition of a quality Learning Environment is broad. It is characterised by its ability to meet varied learner needs adaptively (Tohara, 2021), provide holistic personal development, and maintain a pedagogical stance that is both inclusive and forward-thinking (Blackmore et al., 2011; Fisher, 2021b; Ma et al., 2020; Sasson et al., 2022). When these Learning Environments are effectively integrated with ICT, such environments promise amplified benefits (Imms, 2018; Mishra et al., 2021; Newhouse, 2017; Puentedura, 2010; Young et al., 2020); however, these positive outcomes are dependent on the way that ICT is used (Farjon et al., 2019; Puentedura, 2010; Ramorola, 2013; Tondeur, Scherer, Baran, et al., 2019). As the incorporation of ICT in education becomes more prevalent (Adedoyin & Soykan, 2023), it makes sense to examine the underlying theoretical frameworks that guide its effective incorporation into Learning Environments (Chugh et al., 2023).

An important consideration of a quality Learning Environment is ensuring equitable access to the ICT used for learning (Cheshmehzangi et al., 2023; Lythreatis et al., 2022). Disparities in access to ICT can lead to a digital divide, where some students benefit significantly while others fall behind (Adhikari et al., 2017). Such inequitable access harms academic success and student well-being (Aissaoui, 2022; A. R. Golden et al., 2023; Grimes & White, 2019). Research in NZ has shown that schools must provide equal access to ICT resources so all students can take advantage of technological advancements (Corkin et al., 2022; Kuteesa et al., 2024; Starkey et al., 2017). This requires adequate infrastructure, such as reliable internet connectivity and up-to-date hardware, and should consider the needs of students from varied socio-economic backgrounds (Aotearoa, 2022; Grimes & White, 2019). Such infrastructure is a foundational element of a quality Learning Environment (Barrett et al., 2019; Shmis et al., 2019).

2.3.1 Theoretical Frameworks Associated with a Quality Learning Environment That Incorporates ICT

There are many theoretical frameworks associated with the use of ICT in the classroom, including a proliferation of new frameworks, that can inform us of how to best implement ICT (Chugh et al., 2023; Parker, 2023). Publications continually introduce new theoretical frameworks for ICT-incorporated pedagogy (Agostini & Francesconi, 2021; Mansour &

Yassin, 2022; Sasson et al., 2022), and academics continue to recommend more research in this area (Qazi et al., 2021; Richmond et al., 2020; Zhou & Ye, 2023). In reviewing 503 recent publications on learning that incorporate ICT, Hew et al. (2019) identified a total of 183 theories, of which 35 were explicitly on educational technology, while Kereluik et al. (2013) identified 15 significant 21st-century learning frameworks and tried to synthesise them into a single one.

A reason why there are many theoretical frameworks is because of the many interrelated factors involved in the incorporation of ICT within Learning Environments. Timotheou et al. (2023) illustrate the many significant factors contributing to effective ICT incorporation into Learning Environments (Figure 2.2). While the availability of infrastructure is central to the integration of ICT in Learning Environments (Lomos et al., 2023b), a plethora of non-technical factors play an important role in determining ICT's effectiveness (Newhouse, 2017; Peng et al., 2023). The School leadership is important in establishing the tone of plans that involve ICT (Fios et al., 2024), as their vision and commitment shape the environment in which ICT is effectively adopted or passionately resisted (Butler-Henderson & Crawford, 2020; Heatherton & Trespalacios, 2021). Equally important are the socio-economic backgrounds, which can influence access to digital resources, and digital literacy levels (Liao et al., 2022). Teachers' personal characteristics, their openness to change (Huma Akram et al., 2022), and adaptability also significantly influence the incorporation of technology in pedagogy (Timotheou et al., 2023; Wijnen et al., 2021; Williams et al., 2023).

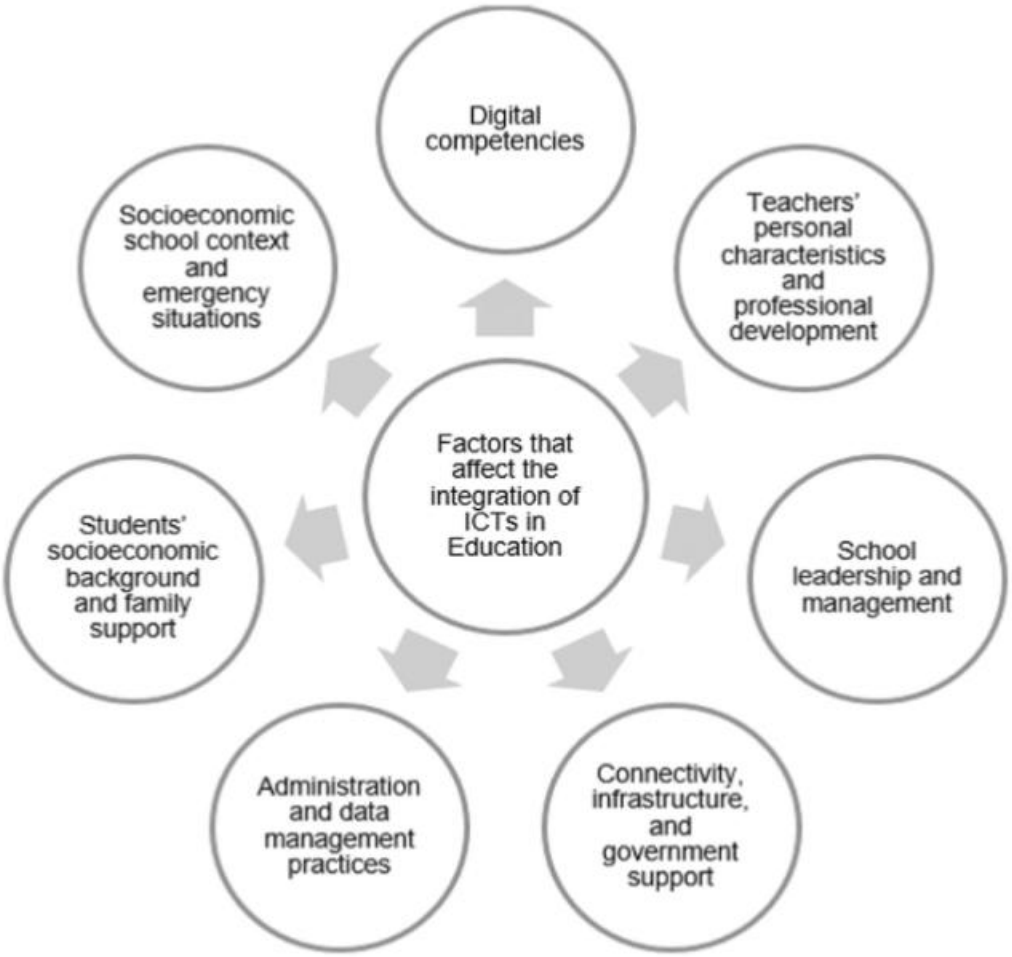

Figure 2.1 Factors That Affect the Impact of ICT on Education (from Timotheau, et al, 2023, p 6715)

Another reason for the multitude of theoretical frameworks is the rapid evolution of ICT (World Bank, 2022), and the contextual nature of pedagogical innovation (Owston, 2007). Since innovation depends on multiple attributes (Morel & Spector, 2022; Traxler, 2007), which are not always applicable in every context (Aparicio et al., 2016; Kolakowski et al., 2020), there is a continuous need for the development of new frameworks to adapt to these changing conditions (Bakon et al., 2021; Franks & Wan, 2022). Also, there are numerous instances where existing theoretical frameworks undergo refinement and renaming to better support changing pedagogical needs. For example, the HEAT Framework (**H**igher-order thinking, **E**ngaged learning, **A**uthentic connections, and **T**echnology Framework) is derived from the LoTi (The **L**evels **o**f **T**eaching **I**nnovation) Framework (Moersch, 2010). Similarly, a framework utilised for this study, the NISS (**N**ew **I**CT **S**upporting **S**chooling) Framework (Newhouse, 2008b), is based on twenty-four prior publications. These sources encompass a

range of foundational theoretical frameworks, and include prominent theories like constructivism (Hatch, 2023), illustrating how the field continually adapts and builds on previous scholarship to address the increasing integration of ICT in education.

A recent trend is that scholars are developing frameworks increasingly focused on specific areas. For example, frameworks have been developed for particular subject areas, such as mathematics (Hwang et al., 2021), and English Language teaching (Greene & Jones, 2020). Frameworks have also been developed for modes of teaching, such as distance learning (Aparicio et al., 2016; Picciano, 2021), gamification (Kabilan et al., 2023; Oliveira et al., 2021) and flipped classrooms (Divjak et al., 2022; Eppard & Rochdi, 2017). As a result, frameworks are increasingly focused on the contextualised and situated application of technology, and this has resulted in research into which learning theories can most suitably be applied to a particular instructional context and the background of the students (Blaschke, 2023; Brieger et al., 2020; Cáceres-Nakiche et al., 2024). Five of these major theoretical frameworks will be reviewed in the next section.

2.3.1.1 Selecting Theoretical Frameworks

Of the many theoretical frameworks, this literature review will focus on four that have gained considerable traction in contemporary research on pedagogy involving ICT and are relevant to this study. These frameworks were chosen because they are conceptually aligned to the focus of this study around effective pedagogy. These are the Substitution Augmentation Modification Redefinition (SAMR) model (Puentedura, 2006), which is illustrated in a ladder-like progression of technology integration levels; the Technological Pedagogical Content Knowledge (TPACK) framework (Koehler & Mishra, 2009), which examines the intersections of technology, pedagogy, and content; ‘New ICT Supporting Schooling’ (NISS) framework (Newhouse, 2008b), which describes the holistic integration of technology into school systems; and the Quality Teaching Framework (Prieto-Rodriguez et al., 2016b), which provides both a criterion for evaluating the quality and effectiveness of teaching practices in contemporary Learning Environments. Recent research has focused on the importance of teacher professional development (Gore et al., 2023).

2.3.1.2 The Substitution Augmentation Modification Redefinition (SAMR) Model

The SAMR Model by Puentedura (2010) is amongst the most widely used to describe how technology can best be utilised in classrooms to improve learning outcomes (Bicalho et al., 2023). It is amongst the most popular models, perhaps because it can be understood easily (Blundell et al., 2022), but it has also been criticised for the fact that it is simplistic compared to other models, such as TPACK (Gleeson, 2023; Kimmons & Hall, 2016; Lindner & Webb, 2022). The SAMR model has been used widely in NZ and abroad to describe pedagogy (Cui, 2020; MOE, 2023). It's popularity is illustrated by the fact that it is difficult to find any recent thesis on ICT-enhanced pedagogy that does not have some reference to SAMR (Bradley, 2020; Farshadnia, 2019; Fields, 2019; Rhodes, 2020; Soto & Herrera, 2023; Williams, 2022).

SAMR is sometimes viewed as a hierarchy, while others say that it is not hierarchical (Heatherton & Trespalacios, 2021; Rowston et al., 2021). A common misunderstanding is that while the SAMR model may visually look like a conceptual hierarchy, similar to Bloom's Taxonomy (Netolicka & Simonova, 2017; Nyayu et al., 2019), it is not strictly hierarchical in terms of the 'levels' (Bicalho et al., 2023; Hamilton et al., 2016). The four factors in the SAMR model, as illustrated in Figure 2.2, do not necessarily indicate a movement from a lower to a higher 'level', but rather indicate a choice of what 'level' is most suitable for a given task (Hamilton et al., 2016).

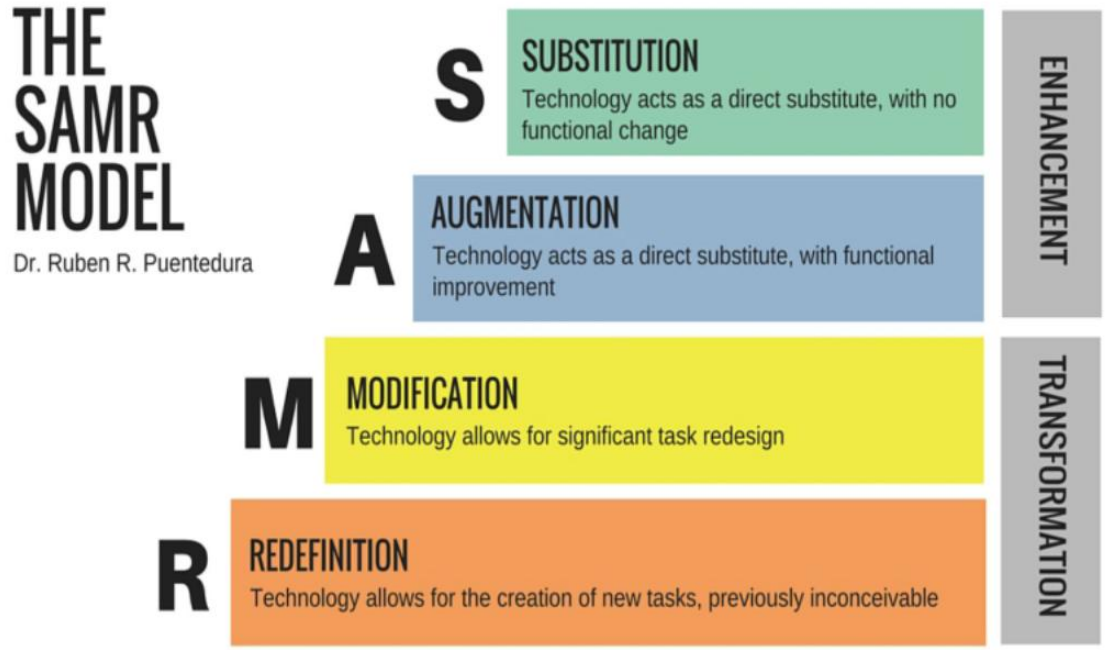

Figure 2.2 The SAMR Model (from Terada, 2010)

At the pinnacle of the SAMR model is the "Redefinition" stage, which illustrates the transformative power of ICT in Learning Environments (Tunjera & Chigona, 2020); (Alivi, 2019; Drugova et al., 2021). At the Redefinition stage, the use of technology allows teachers and students to engage in new tasks collaboratively that were previously inconceivable without the use of digital technology (Blundell et al., 2022; Flores, 2022). As illustrated in Figure 2.2, when one moves towards the *Modification* and *Redefinition* category (from the *Substitution* and *Augmentation* category), technology could be used to transform learning (Arantes, 2022; Blundell et al., 2022). An example of this move towards Redefinition is the utilisation of Learning Management Systems (LMS), such as Google Classroom and Microsoft Teams, a process that is currently occurring in New Zealand schools (Flack et al., 2020). These software applications can enable asynchronous communication (Bradley, 2020), engage students with varied learning styles therefore providing a space for personalised learning pathways (Drugova et al., 2021; Thomas, 2023).

As Drugova et al. (2021), Alivi (2019) and Wilson (2021) state, the Redefinition stage is not merely about substituting or augmenting traditional tasks with ICT. It is about envisioning and executing new learning experiences. This shift necessitates the use of new technologies, and a rethinking of pedagogical strategies to maximise the transformative potential of digital technology, which Kim (2022, p. 221) expresses as "…meaningful tech integration …".

Thus, at the Redefinition stage, technology and pedagogy intertwine in such a manner that the resulting learning experiences are more than "substitution" but is also innovative and transformative.

According to Hamilton et al. (2016), the Redefinition stage surpasses the boundaries of conventional pedagogical practices. It uses ICT to increase student engagement, collaboration, and creativity. This transformative level is the pinnacle of effective ICT usage and involves more than enhancing traditional teaching methods. Instead, it aims to create novel and innovative learning opportunities (Puentedura, 2010; Schwartz & Blau, 2023). In this paradigm, educators are expected to "… think outside the box …" (Idrisova et al., 2023, p. 4). To achieve this, educators are expected to be proficient with digital technology and to envision and create learning experiences that push the boundaries of what is traditionally conceivable. Hence, the Redefinition stage is one where there is a transformation of both teaching and learning, which is made possible by the innovative use of ICT (Tunjera & Chigona, 2020).

Integrating ICT into Learning Environments, especially at the Redefinition stage, is a 'formidable task' (Chien et al., 2023; MOE, 2023). The expectation for educators is to master these 'tech resources' and fundamentally rethink and reshape pedagogical practices. This has also been described as a 'tall order' especially when most teachers are grounded in traditional methods of teaching (Cáceres-Nakiche et al., 2024). For example, according to Blundell et al. (2022), Redefinition is creating unparalleled learning experiences. It often demands a radical departure from conventional methods. However, breaking free from established norms and "thinking outside the box" is often easier said than done (Glăveanu, 2020; Kennedy et al., 2015). This is reflected in the large body of literature focusing on the deficiencies of teachers in their adaptation to contemporary teaching methods utilising ICT (Fernández-Batanero et al., 2022c). This, in turn, points to a concern about the pace at which pedagogy evolves in comparison to technological advancements (Bowman et al., 2022; Wilson et al., 2020; Yildiz Durak, 2021).

Often, scholarly articles focus on the lag in teachers' capacities to integrate ICT effectively into their teaching practices (see Fisher, 2021a; French et al., 2020). This lag is often attributed to factors such as insufficient professional development opportunities (Gore et al.,

2023), the rapid pace of technological change (OECD, 2023e), and a lack of infrastructure or resources in schools (Lomos et al., 2023b). There is also a narrative that suggests that many educators, especially older ones, can be resistant to adopting modern technology. This is because they are not digital natives and may feel overwhelmed or unprepared (Clausen et al., 2023; Scherer & Teo, 2019; Starkey, 2020; Stringer et al., 2023).

While the transformative ability of ICT is well-established (Imms & Mahat, 2022; OECD, 2012), actualising this requires skill, vision and a supportive ecosystem (Newhouse, 2017). It also requires continuous professional development (Gore et al., 2023), and the flexibility to adapt (Adewale et al., 2024; Mishra & Mehta, 2016). While the aspiration to redefine pedagogical practice is admirable, the path to achieving it is easier said than done (OECD, 2023b, 2023c, 2023f).

2.3.1.2.1 Criticisms of the SAMR Model

Despite its popularity, the SAMR model has been met with criticisms. A primary criticism of the SAMR model is its oversimplification of complicated processes of technology integration into Learning Environments (Blundell et al., 2022; Marcovitz & Janiszewski, 2015; Webb & Gibson, 2015). Hamilton et al. (2016) report that the SAMR model's linear trajectory, which ranges from Substitution to Redefinition, can inadvertently suggest to educators that the end goal is always to achieve the Redefinition stage. In addition, the pursuit of Redefinition may not always match the specific objectives or context of every lesson or curriculum (Blundell et al., 2022; Hamilton et al., 2016; Kihoza et al., 2016).

Further complicating SAMR's application is the ambiguity between the four levels, as the boundaries separating the model's four levels are not clearly differentiated (Crompton & Burke, 2020). For example, according to Jacobs-Israel and Moorefield-Lang (2013), what one educator discerns as Modification might be perceived as Augmentation by another, indicating a need for more precise guidelines or exemplars for each level. This can be seen in the example of a teacher who introduces a digital exam to replace a traditional pen-on-paper exam, who may classify this as Augmentation (technology acts as a direct substitute, with functional improvement), while another may view this as Modification (technology allows for significant task redesign).

Perhaps one of the biggest criticisms is the scant empirical support on which the model was created (Blundell et al., 2022). The popularity and widespread acceptance of the SAMR model seem paradoxical when compared with the limited empirical evidence confirming its efficacy in improving student outcomes (Hamilton et al., 2016). Another limitation is the SAMR model's narrow focus on technology. The model is found to lack depth as it omits many factors, such as the Learning Environment, curriculum objectives, or the varied needs of students (Blundell et al., 2022).

In addition, the SAMR model can inadvertently lead to technological determinism, for example, a teacher might feel compelled to use ICT simply because it is available rather than focusing on whether it can genuinely improve learning (Romrell et al., 2014; Svrcek et al., 2022). It is for this reason, Romrell et al. (2014) criticise SAMR for suggesting that technology can drive pedagogical change. Such a viewpoint might overshadow the fundamental roles of pedagogical and content knowledge, which remain integral to effective ICT integration (Mishra & Mehta, 2017). Furthermore, Croupe (2023) argues that an overemphasis on reaching Redefinition might overshadow the foundational importance of stages like Substitution, especially for beginner teachers or those who may be experienced teachers but not have a high level of ICT capacity.

2.3.1.2.2 SAMR Model Applied to NZ Learning Environments

The *New Zealand Ministry of Education* (MOE) website has devoted an entire section to the SAMR model, appropriately titled, 'Using the SAMR model' (MOE, 2023). According to MOE (2023), the SAMR model can assist New Zealand teachers in identifying the optimal level of technology use to improve the existing Learning Environments. Specific examples given are that at the 'Substitution level', traditional tasks, like written essays, could be replaced with digital writing, while at the 'Augmentation level', teachers might employ software, such as interactive quizzes to assess learning progress, which allows students to receive real-time feedback (MOE, 2023).

The New Zealand Ministry of Education emphasises the necessity of digital technology for learning at all levels, suggesting that it can improve student outcomes (MOE, 2022b). They

specifically state that it enables personalised learning pathways, and prepares students for a digital future (MOE, 2021a). Therefore, the application of the SAMR model can assist in achieving these aspirations (Blundell et al., 2022; Heatherton & Trespalacios, 2021; Kelsch & Wang, 2021; Kihoza et al., 2016; Romrell et al., 2014).

The take-home message of the SAMR model is that it provides a structured framework for educators to reflect on and further improve their use of digital technology in a way that can transform learning experiences. By moving through the 'stages' of Substitution, Augmentation, Modification, and Redefinition, educators can progressively shift from merely substituting traditional methods with digital alternatives to creating new learning activities that were previously inconceivable. This progression maximises the potential of ICT and enables a more engaging, interactive, and personalised Learning Environment for students. The SAMR model serves as a simple and effective starting point for integrating technology into the learning environment; however, because technology and the associated pedagogy are rapidly changing, a multi-framework methodology can be more useful (Kenny & Eaton, 2022; Sackstein et al., 2023). Theoretical frameworks such as TPACK (Koehler & Mishra, 2009), The Quality Teaching Framework (Gore et al., 2023), and the NISS Framework (Newhouse, 2008b) have different perspectives that complement the SAMR model and will be discussed in the following sections.

2.3.1.3 The Technological Pedagogical Content Knowledge (TPACK) Framework

The TPACK Framework (Mishra & Koehler, 2006), illustrated in Figure 2.2 below, emphasises the intersection of three types of knowledge: technological knowledge, pedagogical knowledge, and content knowledge.

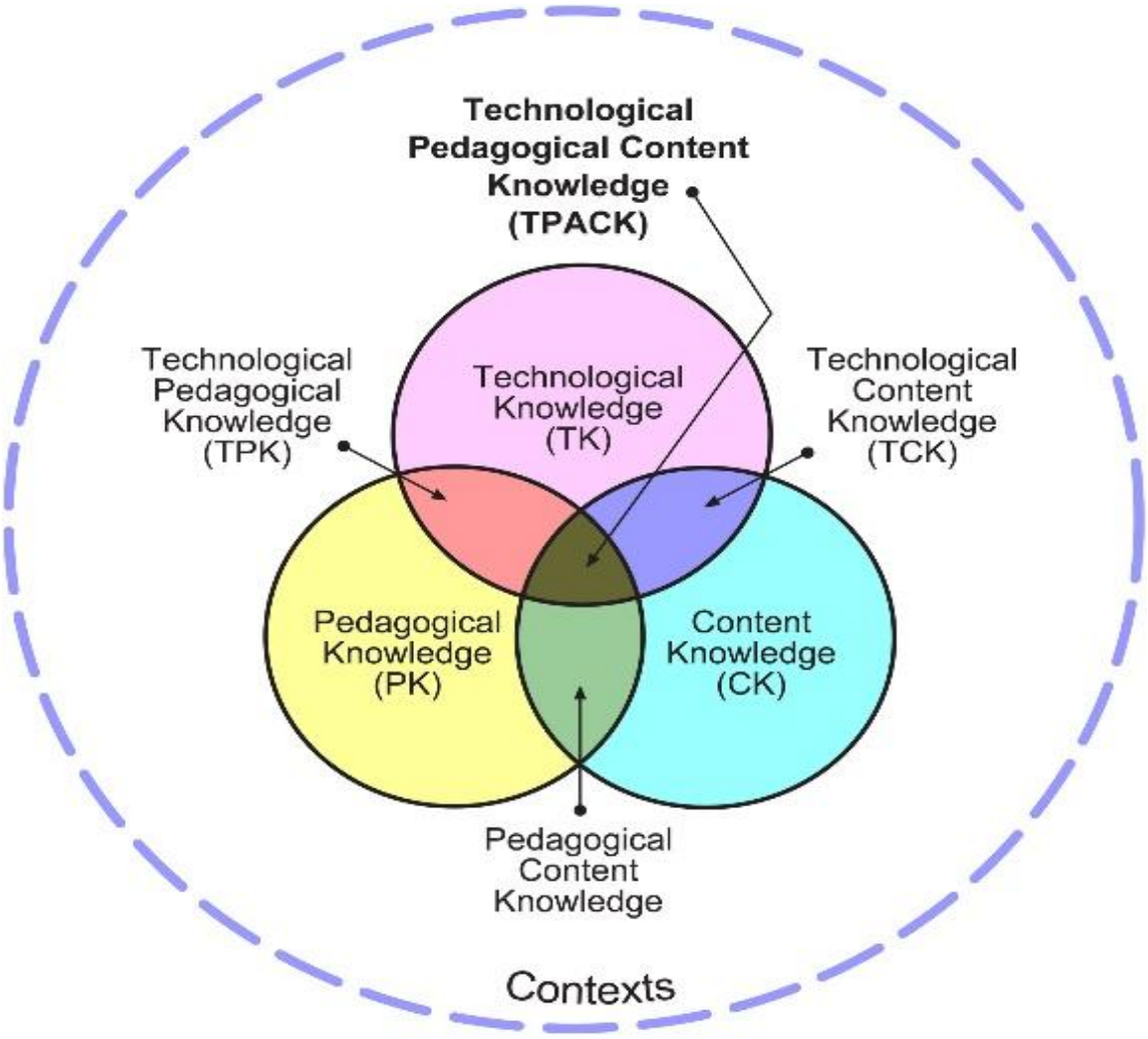

Figure 2.2 The TPACK Framework (From tpack.org, 2012)

Here, the effective integration of ICT into pedagogical practice necessitates an understanding of the relationship between these three types of knowledge (Mishra et al., 2021; Thohir et al., 2022). An interesting difference between TPACK and SAMR is that TPACK does not prioritise the technology itself but rather its strategic integration into pedagogy and content (Rahman et al., 2022).

A core feature of TPACK is its recognition that effective technological integration is not merely about understanding the tool (technology) itself. It is about how it complements specific content within appropriate pedagogical strategies (Koehler & Mishra, 2009). This recognition is based on prior research, mainly by Shulman (1986), and is remarkably similar to Papert's view (Papert, 1993) about technology. Shulman (1986) introduced the idea of

Pedagogical Content Knowledge (PCK). This revolves around the concept that teachers need to deeply understand the subject matter they teach and also how to teach that subject matter (Shulman, 1987). Extending that, TPACK introduces the dimension of technology, highlighting that teachers need to strategically incorporate ICT into this already complex relationship between pedagogy and content (Kong et al., 2023; L. Mishra et al., 2020; Mishra et al., 2021).

Furthermore, the TPACK framework also provides insights into teachers' professional development, which shares common elements with the Quality Teaching Framework (Gore et al., 2023) discussed in the next section. As Koehler & Mishra (2009) point out, their training needs to move beyond isolated technology skills for educators to utilise digital technology's benefits in their classrooms. Instead, teachers' professional development should encompass experiences that enable the simultaneous development of technological knowledge, pedagogical knowledge, and content knowledge. This view is supported by recent research (Fernández-Batanero et al., 2022c; Pinto-Santos et al., 2022; Shurygin et al., 2022). The emphasis on integrated and effective professional development (Gore et al., 2023) can lead to more engaging learning experiences. This is achieved by using ICT in a way that augments and transforms traditional teaching practices, rather than supplementing them (Mishra et al., 2021).

The TPACK framework's take-home message is that successful ICT integration within Learning Environments requires a holistic understanding and practical application of the relationship between technology, pedagogy, and content (Celik, 2023b; Ong & Annamalai, 2023). In other words, educators need to be adept at blending these three factors to create effective and engaging learning experiences. Rather than focusing on the latest in ICT, TPACK identifies what type of knowledge is required to effectively incorporate ICT into pedagogy to improve learning outcomes (Lee et al., 2022). This holistic method provides a basis to incorporate ICT in a way that it is used as a means to transform pedagogy (Mishra et al., 2023).

2.3.1.4 Quality Teaching Framework

Transitioning from technology-focused models like SAMR, the Quality Teaching Framework developed by Dr Jennifer Gore has a focus on pedagogical considerations (Gore et al., 2023; Gore, 2021). The Quality Teaching Framework does not directly consider digital technology integration but considers the larger dimensions of effective pedagogical practice (Gore et al., 2023; Patfield et al., 2023). Gore's framework (see Table 2.2) is founded on three dimensions: Intellectual Quality, a Quality Learning Environment, and Significance (Gore et al., 2023).

Table 2-2 The Quality Teaching Model

Intellectual Quality	Quality Learning Environment	Significance
Deep Knowledge	Explicit Quality Criteria	Background Knowledge
Deep Understanding	Engagement	Cultural Knowledge
Problematic Knowledge	High Expectations	Knowledge Integration
Higher-order Thinking	Social Support	Inclusivity
Metalanguage	Students' Self-regulation	Connectedness
Substantive Communication	Student Direction	Narrative

The first dimension, *Intellectual Quality,* pertains to promoting deep understanding and critical thinking in students. It highlights the importance of connecting lessons to students' existing knowledge, and encouraging higher-order thinking (Patfield et al., 2022). This dimension requires teachers to ask challenging questions, engage students in substantive communication, and ensure that lesson content holds depth in its knowledge base (Gore et al., 2022; Gore et al., 2023; Patfield & Gore, 2023).

The second dimension, *Quality Learning Environment,* focuses on creating classrooms where students feel safe, supported, and are encouraged to take risks in their learning (Potia et al., 2023). This dimension is about the development of student autonomy (Tsai, 2021), encourages positive teacher-student relationships (Wanders et al., 2020), and emphasises the importance of classroom management that helps develop mutual respect (Gore et al., 2017; Gore et al., 2023).

The third dimension, Significance, is about making learning relevant to students' lives. According to Gore et al. (2023), for learning to be effective, students need to see its relevance to their current lives and take their aspirations into account. This means incorporating real-world problems, linking lessons to students' backgrounds, and ensuring cross-curricular connections (Gore et al., 2023; Gore, 2021). Such a framework builds upon other pedagogical theories, such as experiential learning (Berg et al., 2023), and culturally responsive teaching (Ladson-Billings, 2023), which is relevant in NZ (Glassey et al., 2023; Qi, 2024; Rubin & Virtue, 2023) and Australia (Mintrom & O'Neill, 2022; Watene et al., 2023).

2.3.1.4.1 Significance of the Quality Teaching Framework

The Quality Teaching Framework, often referred to as the Quality Teaching Model, has obtained recognition as an extensively researched, established, and generally accepted theoretical framework (Gore & Rickards, 2021; Gore et al., 2023; Harris, Jaremus, et al., 2024; Prieto-Rodriguez et al., 2016a). This framework is widely used in Australia to improve classroom Learning Environments and support teachers' professional practice (Gore et al., 2017; Panayiotou et al., 2021; Patfield et al., 2022; Vaughan et al., 2023). It builds on the Productive Pedagogies Model introduced by Hayes et al. (2000), which, in turn, is derived from the Authentic Pedagogy model developed by Newmann et al. (1992). The Authentic Pedagogy model has been refined over time, and its robustness has been established (Fleming et al., 2020; Gamoran & Weinstein, 1998; Ladwig & King, 2003; Ladwig, 2009). This lineage and continuous refinement highlight the framework's solid foundation in educational theory and its adaptability to changing teaching practices.

Within New Zealand, the Quality Teaching Framework has not been studied (Gore, 2018b), but it has the potential to be of benefit. This is because it has been proven to raise student achievement (Donovan, 2009; Gore et al., 2017; Gore, 2021; Lourie & Rata, 2012) of historically underachieving groups, such as Aborigines in Australia (Boon & Lewthwaite, 2016; Gore et al., 2017). Within NZ indigenous students, especially, Māori and Pasifika academically perform significantly below other ethnic groups (Cao & Maloney, 2017; Crengle, 2013; Mayeda et al., 2022; OAG, 2023; Shearer Rowe, 2016). The NZ MOE

prioritises boosting the achievement of Māori and Pasifika students as mandated by the Treaty of Waitangi (Johnston, 2023; MOE, 2015). Māori and Pasifika students constitute a significant portion of the SDA student population, with Māori students making up 13% and Pasifika students 43%, totalling 56%. This highlights the importance of research customised to their specific needs and contexts.

The Quality Teaching Framework provides a pedagogical framework that is designed to meet the needs of a student population that has a wide range of learning needs (Gore et al., 2023; Gore, 2021; Patfield et al., 2022). It could potentially benefit New Zealand's education system, particularly with Māori and Pasifika students. This is because the Quality Teaching Framework focuses on professional development (Patfield et al., 2022) in addition to incorporating 'significance', 'intellectual quality', and a 'quality Learning Environment' (Gore, 2018b; Gore, 2021; Patfield & Gore, 2023). There is evidence that Māori and Pasifika underachieve because many do not see the value of learning (Kenny, 2022), and that the Learning Environment is not personalised to their needs (Lemon et al., 2023; OAG, 2023; Rajagopal, 2022).

2.3.1.4.2 Constructivism, ICT, and the Quality Teaching Framework

Constructivist strategies for learning have helped schools implement the Quality Teaching Framework (Fischer et al., 2018; Norden & Lloyd, 2023; Panayiotou et al., 2021). Within these constructivist environments, learning results from assembling new information, synthesising it with prior knowledge, and constructing a new knowledge mindset (Afify, 2018; Archambault et al., 2022a; Koohang et al., 2009). As students gain knowledge, their mental models and perceptions expand, allowing them to become active agents in the learning process (Bada & Olusegun, 2015; Chaudhary & Nagar, 2018a; Hong et al., 2019).

Constructivism has guiding principles derived from theoretical comprehension and practical application. These are summarised by Matthews (2020) as having specific 'thoughts' and 'actions'. These principles include active knowledge construction, consideration of prior knowledge and experiences, connections and interactions with people and content, and time to experience and revisit concepts (Bada & Olusegun, 2015; Dykstra Jr, 2023; Girvan & Savage, 2010).

In contemporary pedagogical discourse and publications, many theoretical frameworks that describe the best practices for integrating digital technology in education are heavily influenced, if not directly rooted, in constructivism (Hew et al., 2019; Or, 2023; Schad et al., 2021). Often, these theories emphasise the transformative power of digital technology (Aagaard et al., 2022; Schmidt & Tang, 2020). In addition, they tend to support constructivist strategies where learning is seen as an active, explorative, and student-centred process (Newhouse, 2017; Varas et al., 2023). For example, the TPACK Framework, which guides teachers in integrating technology effectively into their teaching, highlights the importance of a deep understanding of how technology relates to both pedagogy and content (Mishra et al., 2021; Polly & Byker, 2020; Thohir et al., 2022). TPACK, while not exclusively constructivist, has constructivist values, which emphasise the relationship between the student, content, and technology (Koh et al., 2014; L. Mishra et al., 2020; Mishra & Kereluik, 2011).

The literature often repeats the idea that in constructivist Learning Environments, learners actively construct knowledge (Hatch, 2023; O'Connor, 2022; Reid-Martinez & Grooms, 2021). This knowledge is gained from their experiences, rather than passively receiving it (Piaget, 1973; Triantafyllou, 2022). (Chaudhary & Nagar, 2018a; Earl et al., 2021; Reid-Martinez & Grooms, 2021) Constructivism highlight the importance of active engagement (Varas et al., 2023), problem-solving (Treffinger et al., 2023), and critical thinking (B. Thornhill-Miller et al., 2023), all of which are improved by effective ICT integration (Reid-Martinez & Grooms, 2021) and are major aspects of the Quality Teaching Framework.

ICT can provide learners with unique ways to actively engage in learning by providing interactivity where they can experiment, analyse, and create their own understandings (Newhouse, 2017; Olofson et al., 2016; Theobald et al., 2020). An example of this is the effective use of Massive Open Online Courses (MOOCs) (Alemayehu & Chen, 2023; Askeroth & Richardson, 2019; Calvo Salvador & Rodríguez-Hoyos, 2016). Furthermore, technology can also scaffold learning (Ventura, 2020), providing learners with multiple representations of content, and tailoring instruction to meet individual needs (Schmid et al., 2022; Shi et al., 2019). Hence, blending ICT integration with constructivist principles can

lead to more meaningful and engaging learning experiences in classrooms (Kim & Adlof, 2024; Lam et al., 2021; W. Suh & S. Ahn, 2022).

Although the distinction between constructivism as a learning theory and a pedagogical framework has been the subject of debate (Alanazi, 2016; Kintsch, 2009), numerous learning strategies support constructivist learning (Alismaiel et al., 2022a; A. Charania et al., 2021; Kesler et al., 2022). An emerging framework is proposed by Woong Suh and Seongjin Ahn (2022), who looked at utilising *The Metaverse* in constructivist pedagogy. They argue that *The Metaverse*, with its immersive, interactive, and interconnected virtual environment, provides learners with opportunities to build knowledge through direct experiences, social interactions, and virtual simulations. Such a space embodies constructivist principles of active learning (Qureshi et al., 2023) and social collaboration (Thornhill-Miller et al., 2023). It also pushes the boundaries by enabling learners to engage with people of different backgrounds, contend with global perspectives and challenges in real-time (Contreras et al., 2022; Stanoevska-Slabeva, 2022). Furthermore, *The Metaverse* can facilitate the bridge between formal and informal learning, blurring the lines of a traditional Learning Environment Learning, and redefining what it means to learn in the 21st-century (Dahan et al., 2022; Hwang & Chien, 2022).

Among the other strategies often employed in this context are problem-based learning (Gallagher, 2023), collaborative learning (Troussas et al., 2023), self-directed learning (Morris & Rohs, 2023), and reflection (Matriano, 2020), to name a few. Problem-based constructivist learning encourages learners to engage with realistic and complex problems. It has been found to facilitate knowledge acquisition skills (Anggraeni et al., 2023), critical thinking (Fiteriani et al., 2021), and problem-solving skills (Karatas & Baki, 2013; Rahman, 2019; Treffinger et al., 2023).

Intertwined with constructivist learning is collaboration (Feyzi-Behnagh & Yasrebi, 2020), which is often referred to as social constructivism (Feyzi-Behnagh & Yasrebi, 2020; Jie et al., 2020; Rannikmäe et al., 2020). It helps develop knowledge construction through social interaction, where learners actively engage in discussions and negotiations to co-construct knowledge and reach a shared understanding. (Hatch, 2023; Omodan, 2022). This emphasises the role of the learner in controlling and directing their learning, thereby,

developing autonomy and self-regulation (Moura et al., 2023). It also emphasises reflection, which is integral to constructivist learning, allowing learners to examine their learning process and outcomes (Daradoumis & Arguedas, 2020), leading to deeper understanding and improved metacognitive skills (Azevedo & Wiedbusch, 2023; Supena et al., 2021).

Lötter and Jacobs (2020) studied how smartphones can be used as a social constructivist pedagogical tool. They found that when used strategically in the classroom, smartphones can enable interactive discussions, collaborative projects, and knowledge construction among students. The portability and ubiquitous nature of smartphones make them particularly useful for on-the-go research (Salcines-Talledo et al., 2020), allowing students to access information in real-time, and share findings with their peers (Black-Fuller et al., 2016; Salcines-Talledo et al., 2020). Apps specifically designed for learning such as Kahoot can be employed to support inquiry-based learning (Griffith et al., 2020), further reinforcing the social constructivist principles of active engagement, problem-solving, and co-construction of knowledge (Griffith et al., 2020; Lötter & Jacobs, 2020). Researchers have emphasised, however, the importance of proper guidelines and digital literacy training to ensure that students use these devices ethically and responsibly in academic work (Aljaloud et al., 2019; Hadad et al., 2020; Luo & Watts, 2023).

Constructivist frameworks also seek to provide learners with authentic, learner-centred experiences (Karjalainen & Ojala, 2023) in which learners have high levels of self-determination and agency (Blaschke, 2023; Morris & Rohs, 2023; Pellerin, 2018), evaluate alternative solutions to problems, collaborate with others (Sobko et al., 2020), use multiple modes of representation or technology, and construct their knowledge (Hatch, 2023; Reid-Martinez & Grooms, 2021). The objective is to provide students with ownership over what they are learning (Thibodeaux et al., 2019), a high level of engagement with the learning material (Amina Charania et al., 2021), and the development of social and communication skills (Parker, 2023). In addition, supporting learners' awareness of their own understandings and learning processes has been identified as a significant facilitator for lifelong learning (Anagün, 2018; Commission et al., 2019; Huang & Liaw, 2018; Mohammed & Kinyo, 2020). By developing this self-awareness (Assudani & Kilbourne, 2015), constructivist strategies improve immediate learning outcomes and equip students with the skills necessary for

continuous personal and professional development (Beynon & Harfield, 2007; Ioannidou-Koutselini & Patsalidou, 2015).

Finally, there is an increasing interest in project-based learning and problem-based learning in modern Learning Environments that incorporate ICT (Anggraeni et al., 2023; Kristianto & Gandajaya, 2023; Saad & Zainudin, 2022; Seibert, 2021). These pedagogical strategies, which are influenced by constructivist thought, utilise technology to provide students with realistic, complex problems to solve, facilitating a deep engagement with content and promoting active knowledge construction (Martinez, 2022; Owens & Hite, 2022).

In short, it is nearly impossible to avoid discussing aspects of constructivism when discussing the role of ICT in education (Asamoah & Oheneba-Sakyi, 2017; Duffys & Jonassen, 2013; Matthews, 2020). Most theoretical frameworks that describe best practices of using ICT in Learning Environments either explicitly or implicitly lean on constructivist principles (Fernandes et al., 2020; L. Mishra et al., 2020; Newhouse & Clarkson, 2008). This is most likely the case concerning the Quality Teaching Framework. As previously discussed, this framework emphasises three fundamental aspects of high-quality education: intellectual quality, a quality Learning Environment, and significance (Gore, 2018a). With regards to intellectual quality, ICT provides students with access to a wide variety of resources that democratise knowledge (Bicalho et al., 2023), allowing them to develop a deep level of understanding that is often difficult to achieve by using traditional methods, such as utilising textbooks, and illustrations on a whiteboard (Mishra et al., 2024). In addition, ICT enables students to learn subject matter using digital technology that is immersive and engaging (Pellas et al., 2021; Tang et al., 2022). Constructivist frameworks, supported by ICT, enable this integration, promoting a deeper and more holistic comprehension of the subject matter, which Oluseye et al. (2020, p. 70) aptly describe as bringing "…abstract theoretical concepts to life."

ICT enables the exploration of complex, real-world problems, helping students to apply learning to practical applications (Dare et al., 2021; Ramsay-Jordan, 2020). This is reflected in the Quality Teaching Model's emphasis on problematic knowledge, which focuses on enabling students to understand the ambiguities found in real-world issues (So & Kim, 2009). Through these approaches, ICT and constructivist methods help deliver intellectual quality by

promoting critical thinking, analysis, synthesis, and evaluation, essential components of higher-order thinking that are important for students' intellectual development (Almerich et al., 2020; Gupta & Mishra, 2021).

Interactive digital technology, in combination with constructivist strategies, plays an important role in facilitating active participation in learning activities (Lam et al., 2021; Morris & Rohs, 2023). This combination can make the learning process enjoyable, thus increasing student engagement (Pienimäki et al., 2021). Furthermore, digital technology supports differentiated instruction (Tomlinson & Jarvis, 2023) and personalised learning pathways (Adewale et al., 2024), enabling educators to better cater to individual student needs and strengths (Kem, 2022). This can result in students achieving high standards, which satisfies the Quality Teaching Framework's emphasis on high expectations (Patfield & Gore, 2023). Furthermore, ICT provides opportunities for self-paced learning, helping students develop self-regulation skills as they take control of their learning processes and monitor their progress (Jdaitawi et al., 2022; Shyr & Chen, 2018). This autonomy in learning is significant for developing lifelong learners who are adaptable (Nørgård, 2021; Seevaratnam et al., 2023).

The Quality Teaching Framework also focuses on the importance of 'significance' in effective Learning Environments (Patfield & Gore, 2023). ICT supports this by promoting active, student-centred learning, enabling educators to create more engaging experiences that students find effective (Chen & Tsai, 2021; Woods & Copur-Gencturk, 2024). This integration can amplify the goals of the Quality Teaching Framework, resulting in knowledgeable students who can apply their learning in complex situations. To summarise this section, the effective use of ICT within a constructivist framework corresponds with the principles of the Quality Teaching Framework. By combining elements of different frameworks, educators gain more ideas and strategies, thereby increasing the likelihood of improved academic success.

2.3.1.5 The New ICT Supporting School (NISS) Framework

The frameworks previously discussed (SAMR, TPACK and the Quality Teaching Model/Framework) all offer important insights into how we should implement ICT

effectively in Learning Environments. However, the framework that was developed to directly answer the 'how' question is the New ICT Supporting School (NISS) Framework. It was developed from an extensive review of academic research to explain how to effectively integrate ICT into Learning Environments in schools (Newhouse, 2015b). It was developed from the well-established theory that learning is an interactive social and psychological process (Baars et al., 2021; Barrouillet, 2015; Piaget, 1973; Vygotsky & Cole, 1978). This involves students interacting with the 'components' of their Learning Environment, such as students, teachers, and the physical Learning Environment, thereby, creating a complex network of relationships (Andrews & Delahaye, 2000; Delialioglu & Yildirim, 2007; Hmelo-Silver, 2004; Smith et al., 2005; Webb, 1982). The NISS framework states that ICT can transform Learning Environments when effectively implemented. These ICT-enhanced Learning Environments can vary significantly, while still maintaining their effectiveness (Newhouse, 2017).

The NISS framework does not insist on a particular way to use digital technology. Instead, it outlines the Learning Environment Attributes (LEA) that exist when ICT is effectively implemented within the Learning Environments (These Attributes will be discussed more fully in Section 2.4 of the literature review).

As shown in Figure 2.3, the Learning Environment is supported by four enabling dimensions:

1. Students (Enabling Dimension)
2. Teacher Professional ICT Attributes (Enabling Dimension)
3. School ICT Capacity (Enabling Dimension)
4. School Environment (Enabling Dimension)

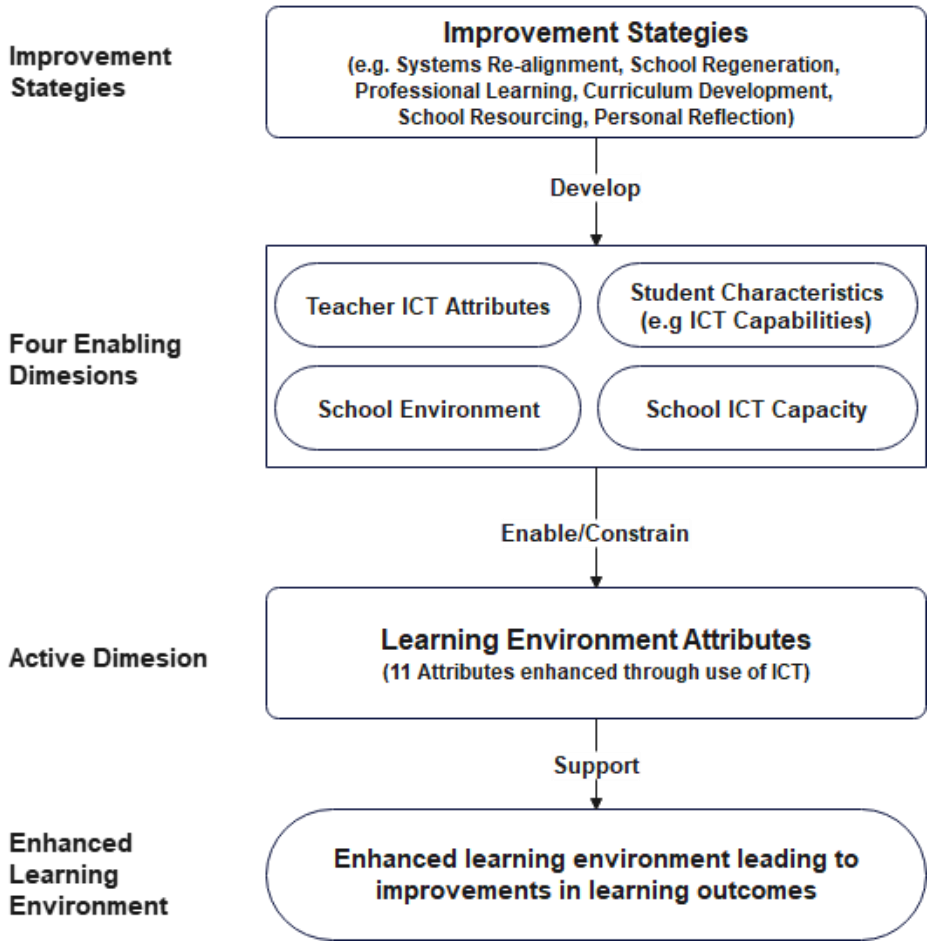

Figure 2.3 NISS Framework (Adapted from Newhouse, 2015)

Scholars advise against drawing direct connections between the usage of ICT and academic performance, even if Figure 2.3 shows this association (Imms et al., 2016b; Mishra & Mehta, 2017). This is because learning takes place in a complex environment with many moving parts (Leithwood, Sun, et al., 2020; Sang et al., 2011), of which ICT is merely one component (Byers et al., 2018; Imms et al., 2017; Park & Weng, 2020). This viewpoint is supported by Mishra and Mehta (2017), who found that it is impossible to evaluate the impact of computer use in isolation from other contextual factors.

The NISS framework adopts a comprehensive view of Learning Environments, recognising that it is more than physical spaces and ICT infrastructure (Newhouse, 2008b). It seeks a deeper understanding, linking learning outcomes with pedagogical methodologies, community participation, and evaluation strategies (Newhouse, 2013, 2015b). Within this framework, teachers and students are considered active participants in the learning process (Newhouse, 2015a), and the relationship among the components significantly influences the extent to which digital technology transforms learning (Newhouse, 2017; Newhouse et al.,

2015). Furthermore, the NISS framework emphasises considering students' ICT capabilities, and champions personalised, relevant, and active learning (Newhouse, 2013, 2015b).

While the Quality Teaching Framework provides educators with a pedagogical guide to increase teacher effectiveness (Gore et al., 2023), the NISS framework demonstrates how these Learning Environments can be significantly improved through the integration of ICT (Newhouse, 2008b). By considering insights from multiple frameworks, educators can understand ICT's role in the Learning Environment and make informed decisions on what can be done to improve academic outcomes.

2.3.1.5.1 The Enabling Dimensions of the NISS Framework

The "Enabling Dimensions" of the NISS framework contribute to our understanding of how to establish a quality Learning Environment that incorporates ICT. They play essential roles in the effective integration of ICT into Learning Environments (Newhouse, 2008b). The following sections discuss these "Enabling Dimensions".

2.3.1.5.1.1 Enabling Dimension: School Environment

The School Environment Enabling Dimension describes elements within the school that set the tone for successful ICT integration (Newhouse, 2008b). The first element, Leadership and Planning, highlights the importance of effective leadership in driving ICT integration within the school (Newhouse, 2008). Effective visionary leaders are essential in establishing direction, developing policies, and allocating the necessary resources for ICT procurement and implementation (Day et al., 2020; Leithwood, Harris, et al., 2020; Machado & Chung, 2015; Marzano et al., 2005; Wu et al., 2019). Planning is equally important, involving the creation of well-defined strategies and goals (Kilag et al., 2024). ICT integration is complex, and this type of planning ensures that problems are minimised (Håkansson Lindqvist, 2019).

The second element, Curriculum Organisation, focuses on the need for ICT to be integrated into the curriculum in a meaningful and systematic way (Newhouse, 2015b). It is essential that the curriculum design engages students, remains relevant to their needs and future opportunities (Grimus, 2020; Voogt & Roblin, 2012). This integration needs to be cohesive,

blending with the institution's overall objectives to ensure that ICT is not used in isolated instances but is embedded in a way that is used frequently and effectively to improve learning (Castañeda & Selwyn, 2018; Kereluik et al., 2013).

The third element, Curriculum Support, focuses on providing necessary resources and assistance to both educators and students. Educators require ongoing training and professional development to effectively employ ICT in their teaching practices (De León et al., 2023; Gore et al., 2023; Patfield et al., 2023). Students, on the other hand, need access to appropriate training and support to effectively use ICT for their learning needs (OECD, 2021f).

The fourth element, Community Connections, plays an important role in successfully integrating ICT (Newhouse, 2008). Engaging with the community, which includes parents (Kartel et al., 2022), local organisations, and relevant stakeholders, is essential (Laho, 2019). This engagement increases collaboration and brings in different perspectives and additional resources, contributing significantly to the effective implementation and sustainability of ICT initiatives (Shea et al., 2022).

The final aspect, Accountability, is to ensure that the integration of ICT is continually monitored and evaluated against predefined goals (Newhouse, 2008). Mechanisms for accountability help in assessing the progress of ICT initiatives, identifying areas that require improvement, and refining strategies (Fontdevila et al., 2021). This ongoing evaluation is essential for maximising the positive impact of ICT on learning outcomes (Newhouse, 2008).

To summarise, the School Environment Enabling Dimension within the NISS framework is composed of multiple elements that contribute to effective ICT integration in Learning Environments (Newhouse, 2008b). These include leadership and strategic planning to curriculum design, support systems, community engagement, and accountability. Each element contributes to creating a holistic environment that is conducive to the effective use of ICT in Learning Environments (Newhouse, 2008b).

2.3.1.5.1.2 Enabling Dimension: Teacher ICT Attributes

Any literature review on Learning Environments, especially in New Zealand, would likely be seen as incomplete without acknowledging the influential work of New Zealand's own Professor John Hattie, celebrated for his book *(Visible Learning, 2023)*. This book highlights that teachers make a statistically significant difference in a Quality Learning Environment (Hattie, 2009; Hattie, 2023). Hattie's extensive research has identified factors that impact student success, and highlighted the very important role of teachers in creating a quality Learning Environment (Corwin, 2023); (Hattie, 2009; Hattie, 2023). His findings have inspired further studies (see Almarode et al., 2019; DeWitt, 2018; Nielsen & KlitmØller, 2021; Yan, 2023). There is evidence of the significant influence of teachers' beliefs and attitudes toward technology on educational success (Li et al., 2019; Richardson, 1996; Scherer et al., 2018; Thohir et al., 2022). Their understanding, capability, and utilisation of ICT may significantly impact the learning experience for students (Koehler & Mishra, 2009; Mishra et al., 2021).

According to Ottenbreit-Leftwich et al. (2010, p. 1322), teachers' beliefs "… may be the most significant barrier to student-centred technology integration." However, the definitions of teacher beliefs vary, and there is debate on how these beliefs differ from attitudes and values (Chiu & Churchill, 2016; Philipp, 2007). It is thought that teachers' beliefs and attitudes are important because they serve as "filters for interpreting their experiences, frames for addressing problems they encounter, and guides for their actions" (Levin, 2014, p. 49). These beliefs and attitudes significantly influence the Learning Environment, affecting its overall effectiveness (Rienties et al., 2016; Shah, 2013).

Using ICT in innovative ways has been intrinsically linked to teachers' beliefs about technology (Ertmer et al., 2012; Judson, 2006; Kim et al., 2013; von Kotzebue, 2022; Wang et al., 2004). These beliefs can either act as enablers, motivating and guiding teachers to use technology effectively, or as barriers, making its effective utilisation even more difficult (Lai et al., 2023; Mishra et al., 2021; Peng et al., 2023). The task of innovatively using ICT is challenging (Hébert et al., 2021; Vásquez-Pajuelo et al., 2024), especially for teachers who feel unprepared (Fernández-Batanero et al., 2021), often due to inadequate training (Rueda & Cerero, 2019) and the pressure to adopt new technologies (Amarilla & Vargas, 2009), leading to anxiety (Pressley et al., 2021) and wellbeing issues (Herman et al., 2021; Jerrim & Sims, 2021).

There is currently a focus on teacher efficacy and technology integration, contributing significant insights (Gomez et al., 2022; Hong et al., 2019; Kundu et al., 2020; Yang et al., 2024). It is common to find studies that use The Technology Acceptance Model (TAM) (Alismaiel et al., 2022b; Vanduhe et al., 2020; Venkatesh & Davis, 2000). This model has been successful in explaining the variance in teachers' success with technology integration, highlighting factors that influence their effectiveness in incorporating technology into their teaching practices (Chocarro et al., 2023; Rienties et al., 2016; Scherer et al., 2019).

TAM argues that the intention to use technology is primarily influenced by perceived ease of use and perceived usefulness (Venkatesh & Davis, 2000). Essentially, if educators perceive technology to be easy to use and beneficial, they are more likely to engage with and implement it in their pedagogical practices (Alfadda & Mahdi, 2021; Kamal et al., 2020; Venkatesh & Davis, 2000). Additional elements, such as external pressures or subjective norms, can also play a significant role in influencing educators' behavioural intentions regarding ICT use (Scherer et al., 2019).

However, for many educators, the sheer volume and pace of technological advancements can be overwhelming. This makes it difficult to keep up and effectively utilise technology in their lessons (Mailizar et al., 2021; Scherer et al., 2019). Constantly changing software and hardware, combined with the expectations of being up-to-date with the latest digital innovations, can exacerbate feelings of inadequacy and distress (Akram et al., 2022; Al-Fudail & Mellar, 2008; Fernandez-Batanero et al., 2021; Kristiawan & Muhaimin, 2019). Therefore, it is recommended to encourage and nurture teachers' intrinsic motivation to adopt ICT (Vinnervik, 2022) and provide ongoing, effective training that matches technological advancements (Gore et al., 2023).

Furthermore, school and institutional cultures significantly shape teachers' attitudes toward technology (Francom, 2020; Lai et al., 2022). Supportive leadership (Bektaş et al., 2022; Machado & Chung, 2015) and collaborative environments can increase teachers' confidence in using educational technology (Buabeng-Andoh, 2019; Redmond et al., 2021). Without such institutional backing, it is challenging for educators, irrespective of their intent or motivation, to be at the forefront of innovative ICT use in classrooms (Imms & Mahat, 2022).

2.3.1.5.1.3 Enabling Dimension: Student Characteristics (ICT Capability)

Student characteristics, particularly their ICT capability, sometimes referred to as 'ICT competency' is increasingly recognised by scholars as a significant enabling factor in contemporary Learning Environments (Astuti et al., 2021; Elstad & Christophersen, 2017; Jackman et al., 2021). According to the NISS framework, students' ICT capability includes eight domains: basic operations and concepts, social, ethical, and human issues, technology productivity tools, technology communications tools, technology research tools, and technology problem-solving (Newhouse, 2008b). Each of these domains contributes to students proficient use of ICT within the Learning Environment, and their associated learning (Newhouse, 2008b).

Basic ICT operations and concepts form the foundation of ICT capability (Cameron et al., 2011; Erwin & Mohammed, 2022; van Laar et al., 2020). This includes understanding how to operate hardware and software, operating systems, and using essential applications (Newhouse, 2008b). Proficiency with essential software, such as word processors, spreadsheets, and presentation software is important (Newhouse, 2008b). These software applications enable students to create, edit, and manage digital content, thereby improving their productivity and allowing them to focus on higher-order thinking tasks (Almerich et al., 2020; Baguma et al., 2019). Mastery of this enables students to collaborate and access a range of perspectives (Ng et al., 2021). Research indicates that proficiency in basic ICT skills serves as a foundation for students to increase their competence to acquire more advanced ICT skills (Ben Youssef et al., 2022; De Wit et al., 2012).

A common assumption is that because this generation of students are digital natives, they already possess ICT literacy and skills (Palfrey & Gasser, 2011; Tilleczek & Campbell, 2019). However, this is untrue. It is now commonly accepted that the 'digital native' is a misconception or a myth (OECD & Eynon, 2020; Reid et al., 2023). While this generation may be comfortable with digital technology and are commonly referred to as 'digitally savvy', at the same time, they may not possess the ICT skills and competencies required to succeed within the Learning Environment (Helsper, 2008; OECD & Eynon, 2020).

Student ICT capability is an essential attribute (OECD & Eynon, 2020), and it is recognised as a 'Key Competency' in the NZ Curriculum (MOE, 2007). Consequently, the development of NZ students' ICT capability is important for academic success and for preparing students to thrive in a technologically driven society (OECD, 2022a, 2023b). This necessitates targeted strategies to ensure all students develop ICT competencies (Ambarsiwi & Priyana, 2020), even though they are digital natives (Davis, 2023; OECD & Eynon, 2020).

2.3.1.5.1.4 Enabling Dimension: School ICT Capacity

The effective integration of ICT in schools' Learning Environments requires an adequate ICT capacity (Lomos et al., 2023b; Newhouse, 2008b). This includes four major components, each playing an important enabling role within the Learning Environment. These components are software, hardware, connectivity, and technological support.

2.3.1.5.1.4.1 Software

Software is an essential part of school ICT infrastructure (Chugh et al., 2023; Newhouse, 2008b; Park, 2020). End-user educational software stands apart from core school infrastructure software and is made of applications that range from applications like *Kahoot* to learning management systems such as *Moodle*. Educational software is designed to support different teaching methods and to accommodate different pedagogical practices (Turnbull et al., 2020) that include individualised learning (Washington, 2019), and collaborative projects (Muydinovich, 2022).

Interactive ICT-based tools such as *Khan Academy* and *Udemy* can positively change the classroom experience (Kaur et al., 2020; Tuma, 2021). They chunk information, enable engagement, promoting higher retention rates and a deeper understanding of complex topics (Roque-Hernández et al., 2023). With the incorporation of augmented and virtual reality (Lowell & Tagare, 2023; Marougkas et al., 2024), such tools can transform abstract theories into relatable, hands-on experiences for students, facilitating an effective knowledge transfer process (Liaw et al., 2023). In addition, Learning Management Systems (LMS) have become an indispensable tool (Camilleri & Camilleri, 2022; Turnbull et al., 2020). They provide an organised framework for course management, content distribution, assessment tracking, and

communication between educators and learners (Camilleri & Camilleri, 2022). Implementing learning management systems, like Moodle and Google Classroom, has an impact on streamlining lessons, in addition to enabling distance/remote learning (Aljawarneh, 2020; Umamah, 2019).

The efficacy of ICT within Learning Environments is heavily dependent on the quality, relevance, and flexibility of the software that the Learning Environment employs (Bedenlier et al., 2020; Gordillo et al., 2022). Schools that utilise such software effectively can significantly increase learning outcomes (Almusaed et al., 2023; Gudkova et al., 2021). However, getting the most out of these software applications requires the availability of technology, adequate training and support for teachers (Moses et al., 2012; Turnbull et al., 2020). As educational software continues to evolve, schools need to be willing to invest, to sustain their relevance and effectiveness in facilitating 21st-century learning (Imms & Mahat, 2022).

2.3.1.5.1.4.2 Hardware

Central to the ICT infrastructure that students and teachers interact with is the hardware component (Chugh et al., 2023; Rutkowski et al., 2022; Tomczyk & Fedeli, 2022). This includes the physical equipment and devices, such as computers, smartphones, laptops, and tablets, which form the foundation of an innovative Learning Environment. These devices are essential as they serve as the main way for users to access and interact with digital content (Tømte et al., 2020). The robustness, durability, and ease of use of these devices play an important role in ensuring a smooth digital learning experience (Bukreiev et al., 2020). Pedagogy today, especially in light of the COVID-19 pandemic (Hall & Lundin, 2024), often relies heavily on the ubiquity and versatility of such devices, using its capabilities for varied instructional methodologies, from synchronous video sessions to asynchronous content engagement (Allen, 2021; Ofori et al., 2023; Werner & Woessmann, 2023).

In tandem with these devices, interactive whiteboards and projectors have emerged as transformative tools in the classroom (Bourbour, 2023; Zhou et al., 2022). These technologies enable audio-visual presentations, and interactive lessons, and encourage a more collaborative learning atmosphere. The ability to visually represent, manipulate, and engage

with content in real-time can significantly increase comprehension and retention (Bourbour, 2023; Ng, Lee, et al., 2023). In addition, hardware that has assistive technology built in is of particular benefit to students who have disabilities, for example, specific devices are made for students who have hearing or sight disabilities (Chand, 2018; Fernández-Batanero et al., 2022a; Svensson et al., 2021).

However, the presence of these devices is not the sole determinant of effective ICT integration (Newhouse, 2012; Newhouse et al., 2015; Saini & Goel, 2019). The quantity and quality of hardware (TKI, 2023), its ongoing maintenance , and its equitable accessibility play a substantial role in determining the ICT capacity of a school (Anita Ramsetty & Cristin Adams, 2020). Making sure that students and educators have access to well-maintained, state-of-the-art hardware is important for actualising the benefits of ICT within Learning Environments (Aotearoa, 2021).

2.3.1.5.1.4.3 Connectivity

Cullinan et al. (2021) and Faturoti (2022) have written about the importance of the internet in education, noting its pervasive influence on contemporary pedagogy. In recognition of the internet's significance within the Learning Environment, the New Zealand government has invested two hundred and eleven million dollars into fully funded internet connectivity for schools. This significant investment illustrates the national commitment to digital connectivity (Beehive, 2022). The New Zealand government has stated that the investment is essential for ensuring fast and reliable internet access, which is, in turn, essential for cloud-based software (Voorsluys et al., 2011). This is particularly relevant for this study, as cloud-based software is extensively utilised in NZ SDA schools (CAS, 2021; LAC, 2021).

The internet opens many educational possibilities. As Pereira et al. (2022) discuss, online learning applications, like *Moodle* and *Google Classroom*, along with emerging technologies, such as Artificial Intelligence (Wang, 2024), are transforming pedagogy by providing access to a wide range of content. These software applications, which are reliant on the internet, enable educators to create and deliver innovative, engaging learning experiences that were previously inconceivable (Bozkurt et al., 2023; Chan & Tsi, 2023).

Aside from retrieving content, the internet is indispensable for communication tools that enable interactive and connected Learning Environments (Miller, 2023). Real-time interactive applications such as *Zoom*, *Microsoft Teams*, and *Google Meet*, have become integral, especially in a time where remote and blended learning is becoming common practice (Agustina & Suharya, 2021; Contrino et al., 2024; Gordon, 2020). Collaborative software like *Google Workspace* and *Microsoft Office 365*, enable teamwork and project-based learning, allowing students and educators to collaborate in real-time despite geographical distances (Akcil et al., 2021; Castañeda & Selwyn, 2018).

However, as alluded to earlier, the effectiveness of ICT is heavily dependent on the quality of internet connectivity. Haleem et al. (2022) and Beranek (2022) point out that bandwidth, speed, and stability are essential for a smooth digital learning experience. Bandwidth affects the capacity for data transmission, impacting activities like video streaming and large file downloads (Beranek, 2022). Reliable and fast connectivity is essential for enabling jitter-free online interactions, while stability is necessary to provide uninterrupted user experience (Lai & Widmar, 2021).

2.3.1.5.1.4.4 Technical support

A school's ICT capacity is not solely reliant on software, hardware, and connectivity. It significantly hinges on the human aspect, i.e., the technical support system (Chen et al., 2022; Wang, D. Tigelaar, et al., 2022; Woo, 2016). To maximise the benefits of ICT in Learning Environments, readily accessible technical support is indispensable (Deacon et al., 2023; Nawaz & Khan, 2012). This technical support encompasses IT professionals and support staff (Caratiquit & Caratiquit, 2022). Their roles often extend beyond hardware and software troubleshooting (Moses et al., 2012). They also engage in proactive maintenance, such as system updates, patching vulnerabilities, and optimising performance (Strudler & Hearrington, 2008). These professionals often serve as the first line of defence against disruptions, from minor glitches to more extensive system failures, so that problems are minimised and students and teachers are able to have uninterrupted ICT services (Strudler & Hearrington, 2008). Fast technical support helps to rectify issues and instils confidence among educators (Satiman & Zulkifli, 2022; Wang, D. Tigelaar, et al., 2022). Knowing they

have a safety net can allow users to experiment and innovate, thereby maximising the potential of ICT within their Learning Environments (Satiman & Zulkifli, 2022).

2.3.1.6 Summary of How to Establish a Quality Learning Environment That Incorporates ICT

Each framework discussed gives us an insight into how to create a quality Learning Environment that incorporates ICT. The SAMR model shows that there is a continuum in the ways that the use of ICT can impact learning, and the use of ICT should be matched to the outcomes educators are trying to achieve. The TPACK model (Koehler & Mishra, 2009), in particular, emerges as a comprehensive conceptualisation of how technology can be optimally interwoven with content and pedagogy. TPACK emphasises the understanding of the relationship between technological knowledge, pedagogical knowledge, and content knowledge (Celik, 2023b; Ong & Annamalai, 2023; Thohir et al., 2022). It says that effective technology integration is more than the sum of its parts (Koehler & Mishra, 2009; Mishra et al., 2021). Unlike the SAMR model, which tends to view digital technology as a separate entity (Puentedura, 2010), TPACK focuses on the relationship between technology and the core aspects of teaching. Thus, TPACK provides educators with a deeper insight into how technology can improve learning (Alivi, 2019; Celik, 2023b; Tseng, 2019).

On the other hand, the Quality Teaching Framework focuses on the quality of classroom practices that can raise student academic outcomes (Gore et al., 2023; Gore, 2021). It provides an evidence-based strategy for teaching that focuses explicitly on the importance of creating meaningful, intellectually stimulating, and supportive Learning Environments (Gore et al., 2023). By emphasising elements like significance, intellectual quality, and a quality Learning Environment, the Quality Teaching Model challenges educators to consider how ICT can support pedagogical goals (Gore et al., 2023; Gore, 2021). While the Quality Teaching Model does not explicitly mention ICT; it encourages teachers to utilise resources in ways that support the students with the view that their learning is significant to them. ICT can be an effective resource in the classroom by helping students engage with problematic knowledge, and develop deep-knowledge with deep-understanding, and use higher-order thinking and processes (McPhail, 2021; Newhouse, 2008b).

But it is the NISS framework by Newhouse (2008b) which describes a whole-school model of ICT integration and provides the most explicit advice as to how to achieve successful results with the integration of ICT in the Learning Environment. The NISS framework highlights the importance of the different elements working together. It looks at how the entire school ecosystem, from infrastructure to pedagogical practices, should evolve to utilise ICT in Learning Environments effectively (Newhouse, 2016; Newhouse, 2015a). This perspective is a reminder that isolated interventions, like those implied in the SAMR model, might not yield the desired transformative effects unless embedded in a system-wide implementation (Bicalho et al., 2023; Drugova et al., 2021).

In particular, the Enabling Dimensions of the NISS framework identifies essential factors that support the effective integration of ICT into Learning Environments (Newhouse, 2008b). In the first instance, the school environment is required to be well-organised (Newhouse, 2008b). Effective leadership and strategic planning provide direction, allow for the development of policies, and the allocation of necessary resources for ICT procurement and utilisation (Newhouse, 2008b). Such, strategic planning ensures that schools possess a coherent vision and a structured roadmap, which has been identified as essential (Day et al., 2020; Leithwood, Harris, et al., 2020; Machado & Chung, 2015; Marzano et al., 2005). In addition, a fit-for-purpose curriculum can help embed ICT within the curriculum to enhance the pedagogy. Community connections are also important as they involve engaging parents, caregivers, local organisations, and stakeholders. Finally, accountability mechanisms need to be implemented to monitor and evaluate the progress of ICT initiatives to be assessed against predefined goals. This also allows for necessary adjustments and improvements (Fontdevila et al., 2021). Collectively, these elements create a conducive environment that supports the effective integration of ICT into the Learning Environments (Newhouse, 2008b).

In addition to these organisational factors, teacher ICT attributes and school ICT capacity are important components that significantly influence the effectiveness of ICT integration. Teachers need to possess a clearly defined vision for how ICT can transform learning, demonstrate competence in using ICT, and effectively integrate this digital technology into their pedagogical practices. In addition, research indicates that teachers' attitudes, skills, and confidence in using ICT directly impact their effectiveness in a Modern Learning

Environment (Bruggeman et al., 2021; Mishra & Koehler, 2006). Furthermore, schools need to have the necessary ICT capacity, including adequate hardware, software, connectivity, and technical support, to ensure that both teachers and students can effectively utilise ICT.

2.4 What Are the Possible Outcomes When ICT Is Used in a Quality Learning Environment?

This section describes the possible outcomes and benefits of effectively integrating ICT into a quality Learning Environment. It considers the Learning Environment attributes that exist due to the integration of ICT in classroom Learning Environments. The section begins with a discussion of the attributes identified in the NISS framework (Newhouse, 2008b), and then considers other attributes that have been shown to exist when ICT is implemented in the classroom.

2.4.1 Attribute 1: The Use of ICT Allows Students to Investigate Reality

One significant advantage of integrating ICT within Learning Environments is the ability for students to investigate and understand reality in ways that were previously impossible (Buchner et al., 2022; OECD, 2023b). For instance, geography students can now immerse themselves in the Amazon rainforest through Google Earth or virtual reality tours, gaining insights far beyond what a textbook provides (Hsu et al., 2018; Xiang & Liu, 2017). Science classes benefit from interactive simulations that bring complex physics and chemistry concepts to life, turning abstract theories into engaging, hands-on experiences (Arici et al., 2019; Fan & Geelan, 2013). Online applications like *Microsoft Teams*, *Google Meet*, and *Zoom* enable real-time conversations with experts, such as astronauts while they are in space (NASA, 2023). These immersive experiences enhance traditional teaching and deepen students' connection to the content (Archambault et al., 2022b). By incorporating ICT into the learning environment, abstract concepts may become 'tangible', enabling students to actively engage with a wide range of learning materials (Archambault et al., 2022b; Ferri et al., 2020).

Using ICT to immerse students in real-world scenarios is gaining widespread recognition for positively impacting Learning Environments (Jesionkowska et al., 2020; Mastrogiacomi,

2021; Morley & Jamil, 2021). This method is grounded in the belief that immersing students in real-world scenarios makes their learning more relevant and engaging (Dare et al., 2021; Makransky & Petersen, 2021; Rohm et al., 2021). It is more than rote learning. Instead, it requires students to apply knowledge to real-life situations and understand the consequences of their decisions (Mebert et al., 2020; Rohm et al., 2021; Varas et al., 2023).

Many examples in the literature highlight the efficacy of ICT within Learning Environments; in fact, many journals exist on this topic. For example, *Computers & Education*, *British Journal of Education Technology*, *Education and Information Technologies*, etc. For instance, studies have demonstrated that incorporating real-world problems through hands-on activities in STEM education significantly improves learning (Cayubit, 2022; Chien et al., 2023; Martín-Páez et al., 2019). Weng, Chiu, et al. (2022b) found that tackling relevant problems can increase student motivation and involvement in learning tasks. A survey by Yazzie-Mintz (2007), which included 80,000 students across 110 high schools in the United States, revealed that 75% of the students experienced boredom at school, with 39% perceiving the material as irrelevant. Integrating real-world experiences in pedagogical practice has been proven to improve student engagement and interest (Aparicio et al., 2021; Subramainan & Mahmoud, 2020).

Technologies, such as AI, VR, augmented reality, and simulations, allow students to investigate real-world scenarios safely within the classroom (Holmes et al., 2023; Richardson et al., 2023; Schwartz & Blau, 2023; Zhang, Chen, et al., 2022), and educators to provide immersive, interactive, and real-time experiences, enabling students to research complex subjects, simulate real-world scenarios, and access global perspectives (Kuhail et al., 2022; Newhouse, 2014, 2017). Such engagements enhance traditional learning methods, while also nurturing critical thinking, creativity, and inquiry (Kannan et al., 2020; Newhouse, 2017; Peng et al., 2019). This technology enables the exploration of ordinarily inaccessible or hazardous environments, such as nuclear reactors. This improves the learning experience by making it more engaging and relevant to students. (Šiđanin et al., 2020). Using such technology can bring abstract concepts to ‘life’ and allows students to visualise and interact within these environments in ways that traditional learning methods cannot (Hollensen et al., 2022; Rospigliosi, 2022).

However, there are barriers to effectively incorporating real-world investigations into Learning Environments (Imms et al., 2016b). Designing and executing realistic learning activities is time-consuming, especially when it also needs to conform to onerous and outdated curriculum goals (Campbell-Phillips, 2020; Gouëdard et al., 2020; Ramsay-Jordan, 2020). Educators also need training to guide students through these experiences (Beck, 2019; Liu et al., 2016; Rospigliosi, 2022). Furthermore, issues of equal access to technology can hinder some students from making the most of such activities (Aissaoui, 2021; Liao et al., 2022). While investigating reality can transform student outcomes by making learning experiences more relevant (Ramsay-Jordan, 2020), challenges like lesson planning (Schallert et al., 2021), teacher training (Gore et al., 2023), and access to digital resources needs to be addressed (Mebert et al., 2020; Secret et al., 2020).

2.4.2 Attribute 2: The Use of ICT Facilitates Knowledge-building

Using ICT in Learning Environments enables students to construct and expand their knowledge, leading to a deeper understanding of learning material. Knowledge-building is a fundamental aspect of the contemporary pedagogical paradigm, and a cornerstone of the 21st-century educational frameworks (Guler, 2023; Tan et al., 2021; Teo et al., 2021). Its importance is in creating a student-centric, collaborative, and inquiry-based Learning Environment (La Fleur & Dlamini, 2022; Teo et al., 2021).

As digital technology rapidly expands into Learning Environments, knowledge-building has evolved from traditional learning methods to that which is more collaborative and constructivist (Newhouse & Clarkson, 2008; Scardamalia & Bereiter, 1996). At its core, knowledge-building is not rote learning. It involves deep understanding (Wang, 2024), actively generating new ideas, refining existing ones, and engaging in collaborative discussions with peers (Supena et al., 2021). This implementation of constructivism enables students to develop a deep understanding of concepts (Triantafyllou, 2022), ask relevant questions (Fabian et al., 2022), and engage in critical and creative thinking, thereby encouraging active learners rather than passive recipients of knowledge (Ren et al., 2021; Sawyer, 2022).

Digital Learning Environments can provide a space to enable knowledge-building (Newhouse, 2017; Rapanta et al., 2021; Scardamalia & Bereiter, 2006; Tan et al., 2021). These online environments provide spaces that support student collaboration, knowledge creation, and shared learning experiences (Samoylenko et al., 2022). Gamification apps (Saleem et al., 2022), online discussion forums (Griffin & Roy, 2022), collaborative documents like Google Workspace (Akcil et al., 2021), and digital concept mapping tools (Woldeamanuel et al., 2020) aid students in co-constructing knowledge (Mah et al., 2020), thereby transforming their learning experiences (Ahmed & Opoku, 2022).

However, despite the potential of digital technologies to facilitate knowledge-building, the effective implementation of digital technologies in the Learning Environment is challenging (Kearney et al., 2022). For example, shifting from a teacher-centric to a student-centric Learning Environment requires changes in teaching strategies and curriculum design (Hoo & Hughes, 2017; McElroy, 2022). Educators are encouraged to adopt the role of facilitators rather than providers of knowledge (Bobis et al., 2020). Research indicates that making a transition from a provider to a facilitator is not easy and requires professional development and support to adapt to these new roles (Gore et al., 2023; Habok & Nagy, 2016; Kearney et al., 2022).

2.4.3 Attribute 3: ICT Engages Students in Active Learning

Active Learning occurs when students are engaged as active participants in the learning process (Bean & Melzer, 2021; Børte et al., 2023; Lombardi et al., 2021). The effective use of ICT in the classroom can enable students to engage in active learning (Morris & Rohs, 2023; Newhouse, 2017; Newhouse et al., 2014), increasing student participation and interaction, and leading to higher levels of engagement (ECAWA, 2017; McCormick et al., 2023; Morris & Rohs, 2023). However, it requires teacher-centred strategies that focus on student participation and interaction (Cho et al., 2021).

Active learning has been a core educational focus in Adventist schools, where it is associated with high levels of student engagement (Adventist, 2023). This engagement, which has been found to be effective in a wide range of subjects (Børte et al., 2023; Hite et al., 2024; Patiño et al., 2023), leads to better knowledge acquisition and the improved ability of students to

apply this knowledge effectively when solving real-world problems (Dulac-Arnold et al., 2019; Shroff et al., 2019). For example, Slater (2020) implemented active learning principles in an astronomy class and observed higher student achievement, attitudes, and end-of-course evaluations.

The successful application of Active Learning often involves problem-based or inquiry-based learning (Dulac-Arnold et al., 2019; Onyema, Ogechukwu, et al., 2019). In addition, self-efficacy, which refers to individuals' beliefs in their capacity to execute specific tasks efficiently, has also been found to be an important component in Active Learning situations (Cai et al., 2021; Jin & Harp, 2020).

Active Learning strategies also provide opportunities for students to make connections between their faith and learning (Ascough et al., 2018; Beech, 2021). By involving students in practical scenarios and encouraging them to reflect on their experiences, Active Learning aids in the internalisation and application of Christian principles and values (Holmes, 2001). Collaborative learning often includes Active Learning components, which synergise with the Christian understanding of community, encouraging mutual respect, cooperation, and the care for others (English et al., 2003). By engaging students in the learning process, teachers can nurture learners to be academically competent and socially responsible (Coley, 2012; Hartikainen et al., 2019).

2.4.4 Attribute 4: The Use of ICT Encourages Authentic Assessment Tasks

Surprisingly, there is no universally agreed-upon definition of 'authentic assessment' (Gulikers et al., 2004; McArthur, 2023). However, its crux is in assessing students' understanding in ways more attuned to real-world applications than conventional assessment methods (Ajjawi et al., 2020; Jopp, 2020). This shift often means transitioning from standardised tests towards more task-oriented assessments that mirror the skills and competencies students will require to succeed in real-world scenarios (Juanda, 2022; Villarroel et al., 2020). Authentic assessments are classified as such when they directly examine a student's performance and understanding of a subject matter, as opposed to utilising indirect or proxy substitutes like multiple-choice tests, true/false quizzes, and long and short answer tests, which are typical characteristics of traditional or summative

assessment methods (Singh & Thurman, 2019; Tepper et al., 2020). For example, Wijaya (2020) describes using a digital video project to authentically assess students' speaking skills.

The effective integration of ICT within Learning Environments provides a way to administer authentic assessments (Nieminen et al., 2023; Villarroel et al., 2020). By using ICT effectively, educators can create immersive, complex tasks that require students to apply their knowledge and skills in contexts that resemble real-world situations (Tepper et al., 2020). In such Learning Environments, students demonstrate their understanding of a subject matter, and their problem-solving, collaboration, and critical thinking skills, which are essential for success beyond school (Davidson et al., 2019; Jopp, 2020; Karunanayaka & Naidu, 2021).

The importance of authentic assessment, often referred to as 'Assessment for Learning' in the New Zealand Curriculum (MOE, 2019), is a core constituent of the 21st-century pedagogical framework in NZ (Juanda, 2022; MOE, 2019). This shift toward more authentic forms of assessment in digital Learning Environments marks departure from traditional evaluation methods, paving the way for a contextualised understanding of student performance (Darling-Hammond & Snyder, 2000; Jopp, 2020; Sokhanvar et al., 2021).

Despite the advantages of authentic assessments, its practical implementation is challenging. One major challenge is the design and evaluation of these tasks (Villarroel et al., 2020). Unlike traditional assessments, authentic tasks often have multiple acceptable solutions and require subjective judgment in grading (Grant et al., 2021). This requires a shift in the role of teachers from evaluators to facilitators and often requires additional training and support (Juanda, 2022).

Furthermore, the effectiveness of authentic assessments is contingent on the full implementation of digital technologies; that is, the technical ICT systems are required to be correctly functioning (Nieminen et al., 2023). Inadequate technical skills and technical support can reduce the efficacy of these assessments (Janse van Rensburg et al., 2022). Thus, to optimally implement authentic assessments, both technical and pedagogical aspects should be considered (Barber et al., 2015; Nieminen et al., 2023). In short, authentic assessment holds significant promise for improving student learning outcomes by making the assessment process more relevant and engaging (Janse van Rensburg et al., 2022; Tai et al., 2023).

However, to realise its benefits, educators are encouraged to address challenges related to design, evaluation, and the role of ICT (Bearman et al., 2023; Nieminen et al., 2023).

2.4.5 Attribute 5: The Use of ICT Increases Student Engagement

A high level of student engagement is essential in well-functioning Learning Environments (Hattie, 2023; Kelly et al., 2022; Klem & Connell, 2004; Kuh, 2001; Pedler et al., 2020). Engagement is generally defined as active participation in the learning process (MOE, 2016a). Kuh (2003, p. 25) expands this definition by explaining it as "The time and energy students devote to educationally sound activities inside and outside of the classroom, and the policies and practices that institutions use to induce students to take part in these activities." There is widespread consensus about the relationship between student engagement and learning (Heflin et al., 2017; Nkomo et al., 2021; Yang et al., 2018). It is viewed as an indicator of good classroom instruction and has been linked to success for students, employees, and employers (Bond, 2020; Pedler et al., 2020; Singh, 2016).

Student engagement is classified into four main categories: academic, behavioural, cognitive, and affective (Christenson & Pohl, 2020; Kelly et al., 2022). While behavioural engagement, such as focusing on the teacher, can be observed directly, cognitive engagement requires a more in-depth understanding of the student's focus (Shi et al., 2021). Student engagement also entails learner agency, which is defined as a learner's ability to take initiative and regulate their behaviour (Christenson & Pohl, 2020). Students who feel in control of their Learning Environment are more likely to be active participants, and this sense of "agency" can significantly influence learning outcomes (Silvola et al., 2021). When students can connect the content to their interests (Ryan et al., 2022), set personal goals (Weber et al., 2022), and make decisions about their learning (Lin et al., 2023), they develop lifelong learning skills (Peters & Romero, 2019), and feel enabled (Butler-Henderson & Crawford, 2020; Singh et al., 2022).

ICT can increase student engagement (Newhouse, 2008b; OECD, 2023g; Wijnen et al., 2021). However, the efficacy of ICT in classrooms hinges not merely on its presence, but on its systematic integration into pedagogy (Lomos et al., 2023a; Newhouse, 2017; Puentedura, 2010). The literature indicates that the capacity to engage students within ICT-enhanced

Learning Environments is not an automatic outcome; instead, it emerges from deliberate pedagogical strategies that effectively use the capabilities of ICT to transform the Learning Environment and increase student engagement (Lokanath Mishra et al., 2020; Warr et al., 2019).

As previously discussed, successful ICT integration requires a whole-of-school strategy. This must include effective leadership and planning (Bektaş et al., 2022; Machado & Chung, 2015), meaningful curriculum design (Tomlinson & Jarvis, 2023), continuous professional development for educators (Gore et al., 2023; Gore, 2021), and the establishment of supportive and collaborative community connections (Leithwood, Harris, et al., 2020). In addition, monitoring and evaluation mechanisms are needed to ensure that ICT initiatives meet their goals and contribute to better learning outcomes (Fontdevila et al., 2021). Within this whole-of-school approach, the use of ICT to increase student engagement can be achieved through intentional, well-planned, and relevant pedagogical choices (Mishra et al., 2021; Newhouse, 2017; Puentedura, 2010).

The benefits of engagement extend beyond the classroom, influencing persistence, retention, and overall achievement (Nkomo et al., 2021; Salas-Pilco et al., 2022; Venton & Pompano, 2021). However, engagement is often negatively affected by external factors, such as restrictive curriculum delivery methods and summative examinations (Bond, 2020; Bond et al., 2020; McMahon & Portelli, 2004).

2.4.6 Attribute 6: The Use of ICT Helps Increase Student Productivity

The relationship between digital technology and learning productivity has emerged as an area of scholarly interest (Collins & Halverson, 2018; Davis, 2023; Kalolo, 2019). Productivity in learning refers to the efficacy of students in translating their learning inputs into outputs. This could encompass the pace at which academic tasks are completed (Woodward et al., 2013), the quality of the work generated (Tóth & Surman, 2019), or the degree of originality in the learning outcomes (Camacho & Legare, 2021). Therefore, the higher the productivity, the more effectively students are utilising their learning resources (Fauzi et al., 2023).

Digital technology has the potential to significantly increase productivity in Learning Environments by providing software applications that streamline academic processes, automate routine tasks, and enable effective communication and collaboration among learners (Haleem et al., 2022; OECD, 2021f, 2023a; Turnbull et al., 2020). These range from basic productivity apps like task managers (*Trello, Todoist,* etc) and digital calendars (*Fantastical*, *Calendly*, *Google Calendar,* etc), to more extensive systems such as learning management software (*Moodle, Skillshare, Khan Academy,* etc). In addition, there are teamwork and project management applications (*Monday*, *Jira*, *ClickUp* etc). However, the relationship between productivity and digital technology is not simple (Amhag et al., 2019). Research by the OECD (2020a) suggests that while effectively using ICT can lead to productivity enhancements, its effectiveness is dependent on its appropriate integration into existing learning routines (Lestari & Santoso, 2019; Maphosa & Bhebhe, 2019).

A major finding in the literature is the positive correlation between digital literacy and productivity among students (Arsyad & Villia, 2022; Peng & Yu, 2022). Students with higher digital literacy tend to utilise ICT more efficiently, thereby improving their productivity (Arsyad & Villia, 2022; Peng & Yu, 2022). This suggests that integrating ICT literacy training into the curriculum is an effective strategy to improve productivity (Cummins, 2023; Fauzi et al., 2023; Kim & Lee, 2021).

2.4.7 Attribute 7: The Use of ICT Helps Students Develop High-Level Thinking Skills

The development of higher-order thinking skills that extend beyond memorisation is becoming important in the contemporary workplace (World Economic Forum, 2023). These skills encompass active learning, exploration of new information, and the discovery and experimentation of new ideas (Ichsan et al., 2019; Thornhill-Miller et al., 2023; World Economic Forum, 2023). Essentially, students who possess higher-order thinking abilities can access information and utilise it in innovative ways, thereby facilitating their capacity to transfer and apply knowledge across a wide variety of situations, of which many could be new (Weng, Cui. To illustrate, higher-order thinking skills may comprise analysing, evaluating, creating, predicting, synthesising, and problem-solving (Supena et al., 2021; Weng, Cui, et al., 2022). These abilities highlight a form of thinking that is abstract,

complex, and challenging, demanding an aptitude to discern relationships, draw connections, and comprehend multiple perspectives (Baguma et al., 2019; Wijnen et al., 2021).

Not all technology use is productive in enabling high-level cognitive abilities among students (Flanigan & Babchuk, 2022; McCoy, 2020; Metruk, 2020). Liu (2014) and O'Donoghue et al. (2004) assert that how computers are utilised as learning tools is important in determining what cognitive abilities are developed. When computers are used as a medium for exploration and problem-solving, they can support the development of higher-order thinking skills (Almerich et al., 2020; Meng et al., 2020). This allows learners to manipulate information, consider many options, and make decisions, thereby improving complex cognitive processes (Liu et al., 2021).

Conversely, a classic example of underutilisation is when computers are used to deliver information, providing only instructions and feedback (Flanigan & Kim, 2021). While this is beneficial for mastering basic facts or procedures, it tends to emphasise lower-order thinking skills (Flanigan et al., 2023). To encourage the use of higher-order thinking skills, the use of technology in Learning Environments should not be restricted to passive activities but should encourage active engagement (Børte et al., 2023) and critical thinking (Code et al., 2020). Furthermore, the use of ICT supports the development of abstract, complex, and challenging cognitive skills (Voogt et al., 2013). For example, using simulation software in science classes allows students to experiment with virtual models of complex systems, such as ecosystems or chemical reactions, enabling them to manipulate variables and observe outcomes in real-time (Zendler & Greiner, 2020).

This hands-on approach encourages students to formulate hypotheses, analyse data, and draw conclusions, thereby engaging higher-order thinking processes (Haryadi & Pujiastuti, 2020). Similarly, using programming tools like Scratch or Python in mathematics and technology subjects can help students develop problem-solving and computational thinking skills by creating their own games or applications (Kroustalli & Xinogalos, 2021). In short, ICT when used in certain ways can help develop higher-order thinking skills (Gupta & Pathania, 2021; Newhouse, 2017; Puentedura, 2010).

2.4.8 Attribute 8: The Use of ICT Helps Increase Learner Independence

Learner independence is an important characteristic of high-quality Learning Environments that incorporate ICT (Ding & Shen, 2022; Lenkaitis, 2020; Mashrabovna, 2022). Developing independence in learners encourages ownership of the learning process, stimulates the development of essential skills and competencies such as self-regulation and intrinsic motivation (Fernandez-Espinola et al., 2020), and improves their overall academic performance (Dron, 2018; Meyer et al., 2008). The effective use of ICT in the classroom often results in a more interactive Learning Environment that increases learner autonomy (Basri, 2023); Sun and Gao (2020).

Research by Johler and Krumsvik (2022a) examined the benefits of ICT withing learning environments. While their scope was broad, their findings suggest that overall, ICT can provide an extensive range of learning materials, which are beneficial in addressing learners' individual paces and interests. This level of customisation is a significant factor in enabling learner autonomy. For example, Johler and Krumsvik (2022a) argue that when learners have the autonomy to tailor their learning experiences, it leads to a deeper engagement with the material. This engagement, in turn, is likely to result in improved academic outcomes (Johler & Krumsvik, 2022a). The ability of ICT to provide a personalised learning experience thus emerges as a significant factor in its effectiveness within Learning Environments (Alamri et al., 2021; Muñoz et al., 2022).

Tomlinson and Jarvis (2023) researched the role of ICT in accommodating the diversity of learners' needs and styles. They found by affording flexibility and adaptability, ICT allows for the provision of individualised instruction (Johler & Krumsvik, 2022a), an important aspect of developing learner independence (Shi et al., 2019; Tomlinson & Imbeau, 2023). Furthermore, for students with special needs, the integration of ICT into their Learning Environment enables access to essential learning material that these students would otherwise not have (Roberts-Yates & Silvera-Tawil, 2019; Svensson et al., 2021). In this regard, the New Zealand Ministry of Education (MOE, 2020b) highlighted how the strategic use of ICT tools can significantly increase learners' independence, supporting inclusive education.

Sanger (2020) stresses the importance of utilising ICT to develop an inclusive Learning Environment. She points out that digital technology helps in customising learning experiences and provides tools that can assist students in overcoming challenges related to their disabilities, thus supporting independent learning. Beetham and Sharpe (2019), in their studies on digital literacy, emphasise that developing these skills is a high priority and that the use of ICT in teachers' pedagogical practice plays an important role in cultivating these skills among learners. This, in turn, encourages independent learning as students become more proficient in managing and utilising online resources independently (Beetham & Sharpe, 2019; Sanger, 2020). These views are well supported by other research, highlighting the widespread recognition of the value of integrating ICT in Learning Environments that support a wide range of pedagogical strategies (Luhamya et al., 2017; Ong & Annamalai, 2023; Shava, 2022).

2.4.9 Attribute 9: The Use of ICT Helps Students to Collaborate and Cooperate

The effective use of ICT in Learning Environments encourages collaboration and cooperation among students (OECD, 2023b), which are important skills (B. Thornhill-Miller et al., 2023). Research indicates that software such as discussion forums (Aderibigbe et al., 2023), shared documents, and collaborative software applications can transform the way students collaborate. These online collaborative software applications provide a space where ideas can be shared and projects co-created, irrespective of physical boundaries (Ansari & Khan, 2020; Chatterjee & Correia, 2020; Liu et al., 2023). For instance, widely used free-for-student-use software, such as Google Workspace and Office 365 allow students to participate in real-time collaborative activities. These cloud-based software allow students to edit shared documents simultaneously, communicate and collaborate within groups (Andrew, 2019; Marone & Heinsfeld, 2023; Yen & Nhi, 2021).

Collaboration and cooperation are fundamental elements in modern Learning Environments, especially in contexts where collective problem-solving and teamwork are increasingly in demand (Sobko et al., 2020; Swanson et al., 2021). The ability to collaborate and cooperate improves students' learning experiences (Zhang, 2013) and prepares them for the collaborative nature of the contemporary workforce (B. Thornhill-Miller et al., 2023). As found by Sobko et al. (2020) and Swanson et al. (2021), effective learning in contemporary

environments is heavily reliant on students' abilities to work in unison, sharing knowledge ideas and opinions to achieve common objectives (Ferraris et al., 2023).

Collaborative pedagogies are rooted in effective communication skills. It focuses on the importance of effectively exchanging ideas among peers (Archambault et al., 2022b). The NZ Ministry of Education (MOE, 2022a) emphasises the different methodologies available for developing these skills. A good example of this is Cooperative Learning (Bores-Garcia et al., 2021; Ferguson-Patrick & Jolliffe, 2018). In this pedagogical framework, students engage in small groups, undertaking tasks that require collective effort and mutual support. Students develop a deeper understanding of the subject matter, while simultaneously working on interpersonal skills (Møgelvang et al., 2023; Xigui Yang, 2023). This method improves academic performance and instils values of teamwork and empathy, which are important for personal and professional development (Bores-Garcia et al., 2021; Ferguson-Patrick & Jolliffe, 2018).

Social media can increase student collaboration and cooperation (Sobaih et al., 2020; Van Dijck & Poell, 2018). If used well, social media can provide a space for students to connect, share information, and engage in constructive feedback exchanges (Abu Talib et al., 2021; Greenhow et al., 2022a). Therefore, using ICT in the classroom can improve individual student competencies. It enables collaboration and cooperation (Blau et al., 2020). This is important because it helps students develop the above-mentioned soft skills that are highly valued in the workforce (Polakova et al., 2023; Thornhill-Miller et al., 2023).

2.4.10 Attribute 10: The Use of ICT in The Classroom Caters to Different Learning Styles

The effective integration of ICT within Learning Environments significantly increases the ability to accommodate different learning styles and helps create inclusive environments where students feel valued (Beamish & Saggers, 2023; Johler & Krumsvik, 2022b; Tomlinson & Jarvis, 2023). ICT enables accessibility to learning content across different times and locations which have previously been barriers (Mazon-Fierro & Mauricio, 2022; Mendoza et al., 2023). It also provides a means for participation for students who may have

disabilities, enabling them to participate optimally in the learning process (Page, Anderson, et al., 2021; Pavalache-Ilie & Cocorada, 2014; Uleanya, 2023).

ICT's adaptability allows for the development of customised and personalised learning content. Lessons can be adapted to the different learning preferences and needs of each student, including those with specific challenges (Chaipidech et al., 2022; Kerimbayev et al., 2023; Troussas et al., 2023). For example, students with disabilities can benefit from software and apps designed for accessibility, such as speech-to-text functionalities or interactive learning tools that do not rely on fine motor skills (Oktalia & Drajati, 2018; Shadiev et al., 2017). Similarly, shy or introverted students might find engaging virtually easier to express their thoughts and ideas in a less intimidating environment, increasing their active participation (El-Sabagh, 2021; Hasanah et al., 2022).

A significant development is that of Adaptive e-Learning (ALE) systems (El-Sabagh, 2021; Elmaadaway & Abouelenein, 2023). These systems adjust the learning material based on real-time feedback, accommodating the pace and style of learning to best suit each student's needs (Martin, Chen, et al., 2020; Muñoz et al., 2022). This personalisation improves the learning experience and increases user satisfaction (Streicher et al., 2019).

In addition, the recent advancement in AI has the potential to enable personalised learning experiences (Celik, 2023b; Holmes et al., 2023; Richardson et al., 2023). This is by analysing large amounts of data on individual student performance and behaviour, commonly known as 'Big Data Analysis', and using those results to personalise content (Nguyen et al., 2023; Williamson, 2024; Yue et al., 2024). AI can also provide customised recommendations and adaptive learning pathways (Fullan et al., 2024; Kim, 2024). This can be particularly beneficial for students who need bespoke solutions due to their different cognitive and emotional needs (Bozkurt et al., 2023; Cooper, 2023).

Thus, the use of ICT in classrooms supports a more student-centred system (Silva et al., 2021; Staley & Freeman, 2017). Institutions may be able to significantly improve the quality of education (Prothero, 2023; Williamson, 2024) by optimally using digital technologies to cater to different learning styles, and by personalising education through AI (Yue et al., 2024), and through differentiated learning techniques (Tomlinson & Imbeau, 2023).

2.4.11 Attribute 11: The Use of ICT Helps Deliver Physical Disabilities Equity

Equity in education, especially for individuals with physical disabilities, requires a dedicated commitment to providing access to learning resources and activities for all (Newhouse, 2008c; Page, Anderson, et al., 2021; Simon et al., 2007). This commitment means considering the capabilities and limitations of all learners, especially when integrating digital technologies into Learning Environments (Fernández-Batanero et al., 2022a; Newhouse, 2008c).

Assistive digital technology has been found to be effective in supporting the learning of students with disabilities. Examples of assistive digital technologies is hardware and software that aids in reading and writing such as *Dragon Naturally Speaking*, and magnification software such as *Magnifier* (Fernández-Batanero et al., 2022b; Lancioni & Singh, 2014). While these digital technologies do not solve every challenge, they significantly help students overcome learning barriers and play an increasingly important role in facilitating students' inclusion in mainstream school programmes (MOE, 2018; Perfect et al., 2018).

Educational equity is a matter of fairness and a legal obligation (Bøyum, 2014; Schuller, 2006). For example, in NZ, legislation mandates that schools must be inclusive of students with disabilities (Powell, 2012). This commitment is reinforced by international accords that New Zealand is a signatory of, such as the *United Nations Convention on the Rights of Persons with Disabilities* (MOE, 2020a).

While the term 'Physical disabilities equity' has been used to describe this requirement (Newhouse, 2008), it may inadvertently exclude students who are not physically disabled but have other special education needs. These can encompass developmental delays, learning challenges, and behavioural and communication difficulties (Newhouse, 2008b). The number of students with these special education needs is on the rise in New Zealand (Gerritsen, 2023). In response, the NZ Ministry of Education provides funding, services, and support, including extra teacher and specialist time, specialised equipment, and educational

ICT tools and software (MOE, 2020b). Ascertaining the exact number of students needing such assistance is a challenge due to the absence of a centralised database (Walters, 2018).

2.4.12 Attribute 12: The Use of ICT Increases the Flexibility of Teaching and Learning Through Blended Learning

The COVID-19 pandemic (WHO, 2020) and the Russian invasion of Ukraine (Velykodna et al., 2023), while distinct events, both exerted significant parallel impacts on pedagogy. As countries scrambled to contain the spread of the COVID-19 virus, nationwide lockdowns and social distancing mandates were instituted (WHO, 2020), leading to the closure of schools (Reimers, 2022a). UNESCO reported that, at its peak, over 1.5 billion students were affected by school closures (Gajdzik, 2022; Ofori Atakorah et al., 2022). As a response, teaching institutions transitioned to emergency remote learning, employing video conferencing software to continue providing education (Alismaiel et al., 2022a; Divjak et al., 2022).

The Russian invasion of Ukraine resulted in a similar educational upheaval for students (Ben-Ezra et al., 2023; Galynska & Bilous, 2022). Infrastructure, including educational institutions, was severely damaged or rendered inaccessible due to military operations (de Alencar Rodrigues et al., 2022). As in the case of the COVID-19 pandemic, the crisis in Ukraine necessitated the swift transition to remote learning to ensure educational continuity for Ukrainian students (Galynska & Bilous, 2022; UNICEF, 2022). Many Ukrainians persevered with their education under dire circumstances. Thirteen-year-old Sofiia Yakymenko, whose experiences have been written about extensively (Cassidy, 2023; ICI, 2023), participated in remote Zoom lessons, organised by Monash University in Australia, during the Russian invasion. These lessons, taught by volunteer teachers, aimed to assist students in conflict zones who were at risk of falling behind (Cassidy, 2023).

Several lessons have been learned during these crises. The main one being that both events illustrated that education is perceived and revered as an essential activity, even in times of severe crisis (Faturoti, 2022; Lorente et al., 2020; Maguire & McNamara, 2020). The collective effort to sustain educational activities, via remote learning, during the global pandemic, or amid an armed conflict, is evidence of this fact (Boisvert, 2022; Reimers & Abdulrazzak, 2020; Voitsikhovskyi et al., 2022). The implementation of emergency remote

learning during the COVID-19 pandemic has led to a widespread acceptance of remote learning as the new norm (Morris et al., 2022). While emergency remote teaching was an immediate response to these crises, the extensive incorporation of online education tools and strategies has transformed the way we now perceive and engage with learning material (Arnove, 2020; Morris et al., 2022; Stanistreet et al., 2020).

Before these disruptive events, online education was often viewed as supplementary or an inferior alternative to traditional classroom learning (OECD, 2021f). Today, institutions worldwide are incorporating remote learning into their core curricula. This includes blending online and offline modalities to provide flexible and accessible learning opportunities (OECD, 2023a; Rapanta et al., 2021; Topping et al., 2022). Traditional didactic pedagogy is often combined with virtual environments that enable discussions, collaborative projects, and even laboratory simulations (Code et al., 2020; OECD, 2021a, 2022b).

Remote learning entails flexibility, allowing students to learn at their own pace (Chen et al., 2021; Collet & Berman, 2023). With recorded lectures, digital resources, and interactive modules, students can tailor their learning experiences to their individual needs (Ewing & Cooper, 2021; Spinks et al., 2021). This democratisation of access to learning material has the potential to 'level the playing field' by making high-quality education accessible to a wider demographic and across remote geographies (Krishnaswami et al., 2022; Melamed & Wadmany, 2022).

Emerging from the shadows of the COVID-19 pandemic, the education sector stands transformed (OECD, 2021f; Shava, 2022). The pandemic-induced emergency remote learning and the resultant innovations prove that students and teachers can be both resilient and adaptable (Bozkurt et al., 2022; OECD, 2021b). Within this transformative and disruptive times, it is plain to see that the education sector is changing (OECD, 2022b, 2023e). As students and educators alike have shown remarkable adaptability, there is a compelling case for reimagining the future of education (OECD, 2023b). The resilience demonstrated during these crises has been nothing short of inspiring (Leask & Younie, 2021), highlighting humanity's capacity to tackle challenges and innovate under difficult circumstances, as evidenced by the creative pedagogy that emerged to ensure continuous learning (Bozkurt et al., 2022; Dietrich et al., 2020). This period has tested the resiliency of

educational systems and provided an opportunity to demonstrate growth and adaptation in the face of adversity (Deng & Sun, 2022; Holliman & Sheehy, 2022).

2.4.13 Attribute 13: Problematic Aspects of the Use of ICT in Learning Environments

The benefits of ICT in transforming pedagogy are well-established (Closs et al., 2022; OECD, 2023e, 2023g). This includes its positive impact on academic outcomes (Kristianto & Gandajaya, 2023). However, it is necessary to also consider the negative aspects of ICT within the Learning Environment.

2.4.13.1 The Use of ICT May Cause Cognitive Overload and Digital Distraction

'Choice overload' refers to a paradoxical situation were having to deal with too many options can impair decision-making (Kerr et al., 2020; Milton et al., 2019; Mitra et al., 2023). This occurs when the presence of these choices results in individuals feeling overwhelmed, causing decision paralysis and increased anxiety leading to impaired decision-making (Bawden and Robinson (2009). The large number of options available can complicate the decision-making process, making it more difficult for individuals to evaluate and select the most suitable option, thereby impacting their ability to make effective and timely decisions (Feroz et al., 2022; Mitra et al., 2023).

Choice overload is a concern in online environments. Online resources often have many choices, and can also include visually striking animations (Dontre, 2020). While this can aid in visual understanding, it can also lead to choice and cognitive overload, a state where the learner's working memory capacity is exceeded (Schmitt et al., 2021; Tzafilkou et al., 2021). This can reduce the effectiveness of learning (Buchner et al., 2022; Carvalho et al., 2020). In addition, the constant connectivity made possible by ICT can introduce numerous distractions (Flanigan & Babchuk, 2022).

Just the presence of a smartphone, even if not in use, can decrease cognitive capacity, making tasks requiring concentration more challenging (Ward et al., 2017). A study by UNESCO found that students who had a smartphone nearby were easily distracted by notifications, and it took them twenty minutes to refocus (WEFORUM, 2023). Studies with a large sample

size, for example, the Programme for International Student Assessment (PISA), also have similar findings (Navarro-Martinez & Peña-Acuña, 2022).

To combat cognitive overload and digital distraction, educators can employ the principle of "chunking", where information is broken down into smaller, more digestible segments (Lah et al., 2018). To avoid students getting distracted by smartphones, schools can establish classroom policies that limit the use of non-essential digital devices, and incorporate periodic technology breaks, where students can briefly check their devices (Hartley, 2022; Kim et al., 2020). Teachers can also create a classroom environment where there is sustained attention, which is achieved by developing mindfulness practices (le Roux & Parry, 2022; Zolkoski & Lewis-Chiu, 2019), which have been shown to increase focus and reduce susceptibility to distractions (Chen et al., 2020; Lindström, 2020).

2.4.13.2 The Increasing Use of ICT May Introduce a Digital Divide

Cutting-edge educational technology is expensive. For example, the Meta Quest 3 virtual reality headset that can transform learning experiences (Clegg, 2024) currently costs NZ$929.99 for the hardware alone, exclusive of ongoing monthly subscription costs (Forristal, 2024; META, 2024). The digital divide is the gulf between those who have access to technology and those who cannot (Aissaoui, 2021; Aotearoa, 2021). The digital divide is more than just physical access to ICT (Harvey et al., 2023), it includes the ability to use technology for educational purposes effectively (Liao et al., 2022; Regions et al., 2022; Sosa Diaz, 2021). Consequently, learners from disadvantaged backgrounds may lack access to software/hardware and lack the skills to utilise them. This can place them at a disadvantage (Aotearoa, 2021; Cheshmehzangi et al., 2023). A recent report found that in New Zealand, during the COVID-19 pandemic, Māori and Pasifika students were disadvantaged because of a digital divide (Aotearoa, 2021), which has been described as a human rights issue (Sanders & Scanlon, 2021).

In many countries, including economically developed ones (Aissaoui, 2021; Mathrani et al., 2022; Ramsetty & Adams, 2020), addressing the digital divide within Learning Environments is essential for both ensuring equitable access to education and future-proofing the nation's workforce (Aotearoa, 2022; Starkey et al., 2017; Striepe et al., 2023). While there are many

ways to address this digital divide, schools need to prioritise improving digital infrastructure, the provision of devices, and connectivity to students (Adhikari et al., 2021). By adopting a holistic strategy, NZ can work towards addressing its digital divide so that all students benefit equally (Adhikari et al., 2017; Samarasekara et al., 2023). However, these efforts are often impeded by political decisions (Ma et al., 2019; Ritzhaupt et al., 2020). The allocation of funds, policy priorities, and regulatory decisions can either help resolve or increase the digital divide (Norris, 2020; Ragnedda & Ruiu, 2020).

2.4.13.3 The Use of ICT May Result in Reduced Social Connection

An emphasis on online interactions inadvertently reduces opportunities for face-to-face communication, a shift that can result in negative effects and reduced social connection (Cingi et al., 2023; Quimí & Alexandra, 2022; Turkle, 2023). This is concerning as direct interactions play an important role in developing interpersonal skills, empathy, and collaboration abilities (Falzon, 2019; Gherheș et al., 2021). Scholars, including Turkle (2016) and Müller and Mildenberger (2021), highlight that students may prefer digital communication due to its controlled nature, affecting their ability to handle spontaneous real-world interactions and conflicts.

Turkle (2023) states that the shift towards online interactions, especially among younger individuals, may result in a decline in social skills. This is described as social skill atrophy, which occurs when the absence of in-person interactions hinders the natural development of the ability to recognise subtle social cues (Keynan et al., 2022). The reliance on digital communication can often filter out non-verbal cues, such as body language, tone, and facial expressions, which are usually essential for the full understanding of what is being communicated (Al Tawil, 2019; Branquinho et al., 2020). The immediacy and brevity of online communication (Spiker, 2014), as enabled by social media and messaging applications such as SnapChat, Twitter, etc, may result in an expectation for rapid responses and hinder the capacity for deep and reflective conversations (Dung, 2020; Espinoza-Celi & Pintado, 2020; Falzon, 2019; Valasmo et al., 2023).

While the shift to online learning reduces face-to-face communication, it does not hinder all aspects of interpersonal interactions. Some NZ students, such as those attending Crimson

Global Academy (an online school), thrive in online environments (Gillies, 2024). It has been argued that online pedagogy can provide alternative pathways for individuals, especially those with social anxieties or communication disorders, to connect and express themselves in ways that might be more challenging face-to-face (Bryant et al., 2020; Keskin et al., 2023; Wang et al., 2020). Giving students the option of communicating using ICT allows them to participate as opposed to being isolated (Luo et al., 2023).

2.4.13.4 Students Falling Victim to False Information

Since the COVID-19 pandemic, the increasing spread of false information has become a globally significant issue (Blankenship, 2021), especially for students who are frequently exposed to misinformation and disinformation. This has led scholars to refer to the current period as the "post-truth era" (Compton et al., 2021; Sinatra & Lombardi, 2020). This issue is particularly acute in NZ, where there has been a noticeable impact on students' ability to distinguish between factual and misleading content (Lipson, 2020). The increasing use of ICT within Learning Environments has facilitated the spread of false information, adversely affecting students' academic performance, and shaping their social perceptions (Osborne & Pimentel, 2022). In response, there has been lobbying for urgent updates to the NZ Curriculum to equip students with the skills to spot conspiracy theories, fake news, and disinformation (Cook, 2023; MOE, 2022c).

In contrast to NZ, Finland has proactively addressed this challenge by integrating information literacy throughout its educational system (Cook, 2023; Vartiainen et al., 2023). Recognised as the European nation most resistant to fake news, Finland ensures that students across all grades learn to evaluate information. This approach aids students in Finland to develop a questioning attitude from an early age (Cook, 2023; Sahlberg, 2021). Adopting Finland's system could have a similar effect in NZ.

While the Quality Teaching Model and the NISS Framework (both previously discussed) do not explicitly address the issue of false information, they emphasise skills such as critical thinking and evaluation (Newhouse, 2008b; Patfield & Gore, 2023). Research indicates that developing these skills is essential in combating misinformation (Haber, 2020; Machete & Turpin, 2020). Studies show that students who are proficient in critical thinking are better

equipped to analyse and question the validity of the information they encounter, thereby reducing the likelihood of accepting false information as true (Haber, 2020; LaGarde & Hudgins, 2018).

2.4.13.5 The Overuse of ICT May Have Health Implications

Extended exposure to digital screens has been linked to a variety of health issues (Oswald et al., 2020; Woo et al., 2016), including eye strain (Kaur et al., 2022) and musculoskeletal problems arising from poor posture (Aksüt et al., 2023). The blue light from screens is known to disrupt sleep patterns (Randjelovic et al., 2023), leading to diminished sleep quality and quantity (Pamela Lavados-Romo et al., 2023), which can adversely impact both cognitive and physical health (Ploderer et al., 2023; Wong & Bahmani, 2022). Poor sleep, in turn, has cascading effects on cognitive functions, such as memory and concentration, and physical health, including weakened immunity and metabolic disturbances (P. Lavados-Romo et al., 2023). Monitoring and regulating screen time may improve academic outcomes for students (Liu et al., 2022; Tak & Catsambis, 2023; Wang et al., 2023).

Beyond the direct health implications, there is a growing concern about students developing addictive behaviours towards gaming and social media, which have been shown to detrimentally affect academic achievements (Maras et al., 2015; Sahin et al., 2016). This addiction to digital games and social media can distract students from their studies and may lead to academic failure (Brunborg et al., 2014; Hale & Guan, 2015).

To address these challenges, it is suggested that Learning Environments be made more engaging, which can help keep students' attention focused on the learning tasks rather than being distracted by the devices they are using (Dubey et al., 2023; McCormick et al., 2023). Equipping students with skills for self-management has been shown to be effective in mitigating the negative impact of excessive screen use (Che et al., 2017). Teaching students to balance their personal online activities with academic responsibilities is important, as self-regulation is essential in coping effectively in online environments that are designed to be addictive and time-consuming (Kaya et al., 2023; Konradt et al., 2021).

2.5 Literature Review Summary

Employing Simon Sinek's 'Golden Circle' strategy (Sinek, 2011), this literature review looked at why we should use ICT in Learning Environments, how to create quality Learning Environments that incorporate ICT, and the outcomes of effective ICT use in the Learning Environment. With respect to why we should use ICT in the Learning Environment, this review has found that ICT use within Learning Environments has increased due to its ubiquitous presence inside and outside classrooms. The accelerating pace of digitalisation in education mirrors societal changes. It is widely accepted that ICT can transform pedagogy, resulting in better student engagement and outcomes. NZ SDA schools have recognised the benefits of ICT. They are in the process of incorporating it in accordance with their distinct educational goals, pedagogical philosophies, and commitment to holistic development.

As well as its potential to transform pedagogy, the use of ICT can facilitate the development of essential 21st-century skills such as critical thinking, problem-solving, collaboration, and communication. These skills are indispensable in the contemporary workforce and are further supported by the enabling factors of ICT in Learning Environments. ICT advancements continuously reshape pedagogy, with innovations like Artificial Intelligence, Augmented Reality, and the Metaverse could play a role in revolutionising pedagogy. Effective technology integration impacts the roles of teachers and students, including things such as curriculum delivery and the design of physical Learning Environments. Now is the time for teachers to demonstrate adaptability as they look to address student needs and implement innovative ideas in the classroom.

With respect to how we should use ICT in the Learning Environment, this review discussed four frameworks that emphasise different aspects of how to integrate technology into the Learning Environment. The SAMR model shows that there is a continuum in the ways that the use of ICT can impact learning. The TPACK model (Koehler & Mishra, 2009), emphasises the relationship between technological knowledge, pedagogical knowledge, and content knowledge (Celik, 2023b; Ong & Annamalai, 2023; Thohir et al., 2022). Effective technology integration has a sweet spot at the intersection of these three knowledge areas (Koehler & Mishra, 2009; Mishra et al., 2021). The Quality Teaching Model challenges educators to consider how ICT can support pedagogical goals (Gore et al., 2023; Gore, 2021).

It emphasises elements like significance, intellectual quality, and a quality Learning Environment. The use of ICT can help teachers to make learning experiences significant to students. ICT can be an effective resource in the classroom by helping students engage with problematic knowledge, and develop deep-knowledge with deep-understanding (Newhouse, 2008b). In addition, it can facilitate the development of higher-order thinking and processes within a supportive learning environment (McPhail, 2021; Newhouse, 2008b).

The NISS framework by Newhouse (2008b) describes a whole-school model of ICT integration. The Learning Environment Attributes describe what happens in the learning environment when ICT is used and the Enabling Dimensions of the NISS framework describe factors that need to be in place to support the effective integration of ICT into Learning Environments (Newhouse, 2008b). Enabling dimensions include School ICT Capacity, School Environment, Teacher Professional ICT Attributes, and Student Characteristics which are key to understanding how to integrate ICT in school learning environments.

The last section of the literature review considered what are the possible outcomes when ICT is used in a quality learning environment. The review found that many of the learning environment attributes identified by Newhouse (2008) were supported in the current literature. The use of ICT allows students to investigate reality, facilitates knowledge-building, engages students in active learning, encourages authentic assessment tasks and increases student engagement. It also helps increase student productivity, helps students develop high-level thinking skills, helps increase learner independence and helps students to collaborate and cooperate. In addition, it caters to different learning styles, helps deliver physical disabilities equity, and increases flexibility by enabling pedagogical practices such as blended and flipped learning.

The review acknowledges that there are some problematic aspects to the use of ICT in learning environments. In particular, the use of ICT may cause cognitive overload and digital distraction. Furthermore, given that ICT is expensive, it often results in creating a digital divide. In addition, the overuse of ICT can result in reduced social connection, with students falling victim to false information. The overuse of ICT may have health implications for students.

Overall, this literature review has highlighted that ICT can make many positive contributions to Learning Environments. Given these insights, examining Learning Environments within NZ SDA schools, with a particular focus on ICT can be of value. This study, therefore, proposes to answer the following research questions:

1. What is the nature of the Learning Environment in NZ SDA schools?
2. What role and impact does ICT play in supporting the Learning Environment?
3. What needs to be established at the system, school, and classroom levels to enhance the Learning Environment in NZ SDA schools; with a particular emphasis on the role of ICT?

In exploring the above three questions, this study aims to provide information that can be useful in enhancing the Learning Environments of SDA schools in NZ.

Chapter 3 Methodology

3.1 Introduction

In this chapter, the rationale, design, and methods employed to achieve the research objectives are described. The chapter describes the mixed-methods research design, which includes quantitative and qualitative components, data collection, and analysis alongside an examination of the ethical considerations associated with this study. Furthermore, it engages with the researcher's positionality and reflexivity, providing insight into their role and perspective within the research process.

3.2 The Sample

Three NZ SDA secondary schools were included in the sample. Two of the schools are on the North Island of NZ, and one of the schools is on the South Island. The quantitative sample included 324 students from year levels seven to thirteen, who completed the online survey.

The qualitative sample had thirty-four participants, who were interviewed. The qualitative sample represented the three stakeholder groups: students, teachers, and principals. Of these, 11 were students from years eight to thirteen, who were selected by the teachers at the schools. There was a total of 19 teachers interviewed from across the three schools. The selection of teachers was performed by the schools themselves. The teaching experience of the teachers ranged from beginning teachers to teachers with 30 years of experience. Four principals were also interviewed.

3.3 Research Design

In academic research, the pursuit of knowledge often necessitates a mixed-methods methodology (Creswell, 2014; Ghiara, 2020; Haynes-Brown, 2022b; Tondeur, Scherer, Siddiq, et al., 2019). This is because mixed methods combine quantitative and qualitative methodology strengths, enabling researchers to capture and analyse a wide range of data,

and provide a more thorough insight into research problems (Creswell, 2014; Haynes-Brown, 2022a). Therefore, incorporating a mixed methods methodology can provide an in-depth understanding of the influence of ICT on Learning Environments in NZ SDA schools.

Choosing to use a mixed methods methodology for this study stems from the recognition that the research questions cannot be adequately addressed through a single lens. Therefore, this study utilised the distinct advantages of both quantitative and qualitative methodology (Creswell, 2014; Fetters et al., 2013; Timans et al., 2019). Quantitative methods enabled the gathering of empirical, numerical data that could be statistically analysed for patterns and trends. In contrast, qualitative methods provided 'layered', more in-depth insights into the participants' perspectives, experiences, and motivations (Creswell, 2014; Fetters et al., 2013).

This combination allowed for a more holistic understanding of the research problem. It enabled a more thorough exploration than either method could independently achieve. This was mainly because by utilising both qualitative and quantitative methodology, we can effectively analyse narratives. This is because it allows for contextual understanding, and subjective experiences captured by qualitative methods, while benefiting from the statistical rigour, generalisability, and numerical patterns provided by quantitative methods (Creswell, 2014; Haynes-Brown, 2022a). Combining these two methods, thus serves to improve the validity, reliability, and depth of our research findings.

However, mixed methods research is challenging, requiring careful attention to methodological design, data collection, analysis techniques, and interpretation (Creswell, 2014; Dawadi et al., 2021; Haynes-Brown, 2022b). The researcher's reflexivity (Watt, 2007; Xu & Stahl, 2022) and ethical considerations are important in ensuring rigour and trustworthiness (Creswell, 2014; Jootun et al., 2009). Reflexivity involves the researcher's ongoing reflection on their biases, assumptions, and influence on the research process (Olmos-Vega et al., 2023; Watt, 2007). It requires a conscious effort to recognise and address how personal background (Davis, 2020), perspectives, and participant interactions might shape the data collection and interpretation (Olmos-Vega et al., 2023). This reflective practice can help to mitigate biases and increase the credibility of the research findings (McGrath, 2021).

The exploratory sequential design chosen for this research followed the methodology by Fetters et al. (2013) and Ivankova et al. (2006). Implementing this mixed-methods research design required the initial stages of this study to be quantitative, followed by a secondary qualitative aspect. The quantitative phase involved the systematic collection and statistical analysis of numerical data, laying the groundwork for the qualitative exploration. The quantitative findings were important in informing the subsequent qualitative phase, shaping the direction and focus of the in-depth exploration. This deliberate structuring allowed for a thorough analysis of the research questions (Creswell, 2014). Specifically, the first and second research questions were addressed using both quantitative and qualitative methods, providing a multidimensional perspective on the data. In contrast, the third research question was explored solely through qualitative methods.

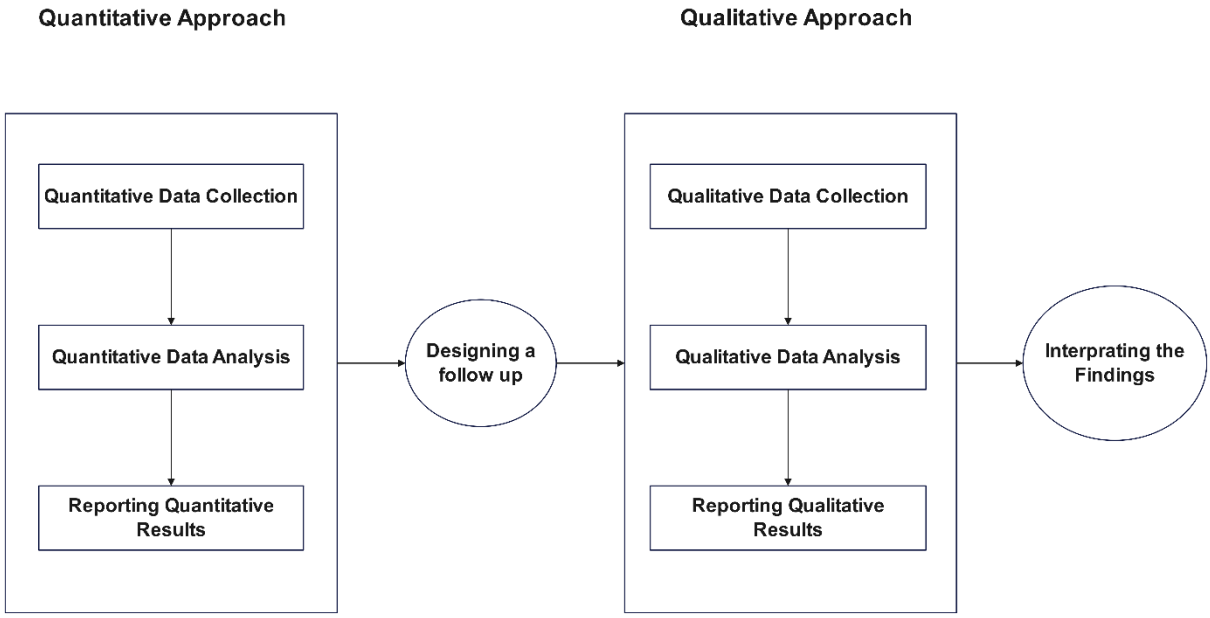

Figure 3.1 The Exploratory Sequential Design for this Mixed-Method Study

Quantitative Phase: This first phase involved creating a survey to gather quantitative data. The collected survey data was analysed using SPSS. A descriptive analysis was then conducted, and the results were analysed and tabulated. Structured equation modelling was then used to find relationships between variables in this study.

Qualitative Phase: Participants' data was collected using semi-structured one-on-one interviews during this second phase of the study. The interviews were recorded, and the

audio data obtained was transcribed for analysis. The transcribed data was then thematically analysed using Reflexive Thematic Analysis (Braun et al., 2023) which is a method for identifying, analysing, and interpreting patterns of meaning within qualitative data. This approach acknowledges the researcher's active role in the analytical process. This allows for flexibility and reflexivity in theme development (Braun et al., 2023). The analysis involved seven steps: familiarisation with the data, generating initial codes, searching for themes among codes, reviewing and refining themes, defining and naming themes, and producing the final report. This method facilitated enabled a deep engagement with the data, enabling the identification of themes that reflect the participants' experiences and perspectives.

3.4 Insider Perspective

Insider perspectives are valuable in mixed-methods research (Creswell, 2014; Dwyer & Buckle, 2009; Holmes, 2020). The main researcher is an IT person/teacher at one of the schools included in this study, which provided a vantage point. This position allowed observations and interactions with fellow teachers and students, providing additional insights that supplemented the research perspective. The immersion in the school environment enabled a deeper understanding of the day-to-day utilisation of ICT, as well as the subtleties of teacher and student experiences with this technology in the learning process.

However, insider research which Mercer (2007, p. 1) describes as akin to "… wielding a double-edged sword …" can have limitations such as bias, loss of objectivity, and challenges in maintaining professional boundaries (Unluer, 2012). To address these limitations, four strategies were employed. First, reflexivity was practised, where the researcher critically reflected on the research process and outcomes (Mercer, 2007). Second, triangulation of data from multiple sources, including interviews, surveys, and observations, was utilised to corroborate findings and mitigate bias (Natow, 2020). Thirdly, the use of MAXQDA software, in addition to extensive debriefing and consultation with my supervision team, ensured that interpretations and conclusions were scrutinised and validated. Finally, maintaining transparency in the research process, including rigorous documentation of decisions and methodologies, helped in mitigating the biases associated with insider research.

The immersion in the school environment provided a deeper understanding of the day-to-day application of ICT in education, as well as the subtleties of teacher and student experiences with technology in the learning process. For example, the researcher could observe the practical challenges and successes of ICT integration in real-time, thus being able to capture data on its effect on pedagogy. This insider perspective also allowed for the identification of specific cultural and contextual factors that influence how technology is perceived and utilised within the school.

Furthermore, being an insider helped in building trust with participants, encouraging them to share their honest opinions and experiences. This rapport is often harder to establish by external researchers and can be important in obtaining data (Creswell, 2014; Finefter-Rosenbluh, 2017). By making use of the advantages of this insider position, we could find out in detail the subtleties of the Learning Environment, collecting data that might have been overlooked by an outsider.

3.5 Validity

Data triangulation was employed to ensure the validity of the data collected in this study. Data triangulation involves integrating and comparing data from multiple sources to draw insightful and accurate conclusions (Dawadi et al., 2021; Fetters et al., 2013; Flick, 2004, 2016). For this research, data was collected through a combination of online questionnaires that utilised *Survey Monkey*, in-person semi-structured interviews, and remote interviews conducted via Zoom (see section 3.5 below for more detail). These varied data collection methods provided different perspectives on the research questions and reinforced the findings by converging on similar conclusions.

The validity of the interview data was established by using clarifying questions. When necessary, follow-up interviews were conducted. The initial six interviews in this study were conducted with the assistance of my PhD supervisor, who helped refine the interview process. A similar technique was then used to conduct the remainder of the interviews. The importance of this clarification process is well-established (Creswell, 2014; Fetters et al., 2013). Interviewers are encouraged to ask probing questions that can elicit thematic responses, encourage interviewees to rephrase or elaborate on their answers or encourage

further discussion. This strategy helps in the accurate interpretation of interview data, allowing for the triangulation of responses to reveal underlying themes, and ensuring a deep understanding of the subject matter (Glesne, 2016; Rapley, 2001). Such attention to detail in the data collection process can help mitigate inaccuracies or misinterpretations in the findings (Creswell, 2014; Luhrmann, 2021; Natow, 2020).

3.6 Data Collection

This study utilised two data collection techniques: a survey conducted electronically via *Survey Monkey* (Appendix 4) and one-on-one interviews (Appendix 1, 2, and 3).

3.6.1 The Questionnaire (Survey)

The questionnaire (Appendix 4) is a customisation of a rubric utilised by Newhouse (Newhouse, 2008) and Beamish (Beamish & McLeod, 2014). This rubric was initially developed by researchers at the Centre for Schooling and Learning Technologies at Edith Cowan University in Western Australia (Newhouse, 2008b). It was designed to investigate measures of the Learning Environment Attributes (LEA) dimension of the NISS framework, originally referred to as LOPA (Learning Outcomes and Pedagogy Attributes) measures (Newhouse, 2008b). Extensive research was conducted within Western Australia, where these measures are compatible with the Principles of Teaching and Learning outlined in the Western Australian Curriculum Framework (Tondeur et al., 2010).

The original rubric draws on reputable sources of information, including the Productive Pedagogies framework from the Queensland Department of Education (Lingard et al., 2003; Mills et al., 2009), research on constructivist Learning Environments, particularly by David Jonassen (Jonassen & Land, 2012), and the Curriculum Framework from the Western Australian Curriculum Council (Newhouse, 2008b). These sources collectively inform the development and implementation of the rubric, so that it is grounded in evidence-based educational theory and practice (Newhouse, 2008b).

3.6.1.1 Theoretical Basis for the Survey Model

The survey in this study included questions regarding students' perceptions of the Learning Environment, active learning using ICT, attitudes towards computers, distraction, ICT use outside school, and age. Each of these variables (illustrated in Figure 3.2) was chosen because of its relevance to the use of ICT in Learning Environments. These variables were identified in the literature review in Chapter 2, and each is summarised in the sections below which also discusses a theoretical basis for including these variables in the proposed model (Figure 3.2).

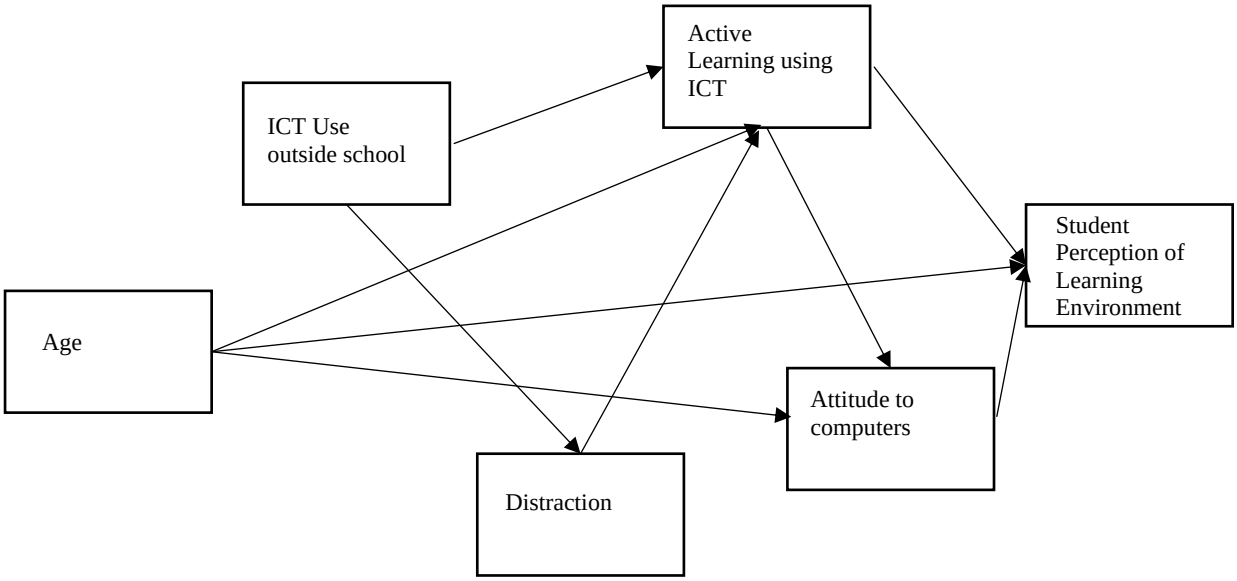

Figure 3.2 Links Between Variables in the Proposed Model

3.6.1.1.1 Students' Perception of the Learning Environment

Students' perceptions of their learning environment are indicators of the quality and effectiveness of these environments (Debs et al., 2023; Mishra, 2019; Newhouse, 2008b). Learning is significantly influenced by the environment in which it occurs (Triantafyllou, 2022; Vygotsky, 1978). A positive Learning Environment can increase motivation, engagement, and academic achievement (Zhongmei Han et al., 2023; Samarasekara et al., 2024).

Students were asked to respond to self-reported measurement of the Learning Environment in their school. The Learning Environment attributes included in the questionnaire (Table 3.1) included engagement and motivation, relevance in learning, authentic assessment, authentic learning, access to information, learner-centeredness, collaboration and cooperation, ICT-supported learning, and adaptability. These constructs are fundamental elements of the NISS framework and are grounded in theory (Newhouse, 2008b), supported by extensive research (Gupta & Mishra, 2021; Halder & Saha, 2023; Koehler & Mishra, 2009; OECD, 2023d; Thornhill-Miller et al., 2023).

Table 3-1 Learning Environment Attributes Included in the Questionnaire

Construct	**Measurement Item [Mostly, Often, Sometimes, Rarely]**
Engagement & Motivation	I do things at school that are good for me
Engagement & Motivation	I am really interested in the things I do in class
Relevance in Learning	I do things in school that are relevant to my life
Authentic Assessment	The assessments I do in class are based on real-world things
Authentic Learning	I do things at school that help me learn about the world
Access to Information	I can access information that helps me solve problems
Access to Information	I use information from outside my class for my schoolwork
Learner Centred	I help to decide what to do at school
Self-paced Learning	I work as fast or slowly as I like in class
Learner Support	I am given help to learn
Collaboration & Cooperation	I share my ideas with a group I am working with
Collaboration & Cooperation	I show my work to my class
ICT Supported Learning	At school, I use the internet to help me do my work
ICT Supported Learning	At school, when I am stuck, I can use the internet to help me move forward
Learning Difficulties	I find the things I do for school difficult
Enabling Learning	I find it easy to work and learn at school
Student Adaptability	I adapted to learning changes during COVID

Engagement and *Motivation* are foundational elements for effective learning, as described by Self-Determination Theory. This theory suggests that students are more likely to be motivated and engaged when their activities are interesting and support their personal goals (Deci & Ryan, 2004; Ryan & Vansteenkiste, 2023). This is reflected in the measurement items, such as "I do things at school that are good for me" and "I am really interested in the things I do in class," which assess intrinsic motivation and engagement, essential for deep learning.

Relevance in learning connects learning activities to students' lives and future aspirations, informed by the concept of situated learning, which emphasises learning within authentic contexts (Davies & Willing, 2023; Karjalainen & Ojala, 2023; Miner et al., 2021). The item "I do things in school that are relevant to my life" assesses how well the curriculum connects with students' real-world experiences and interests, thereby increasing engagement and motivation.

Authentic assessment evaluates students through tasks that mirror real-world challenges (Nieminen et al., 2023; Palladino & Shepard, 2023). The item "The assessments I do in class are based on real-world things" gauges students' perceptions of their assessments as relevant and applicable to real-life situations. Similarly, authentic learning emphasises engaging students in activities that replicate real-world tasks and problems, grounded in constructivist theories of education (Woong Suh & Seongjin Ahn, 2022; Triantafyllou, 2022). The item "I do things at school that help me learn about the world" captures this aspect, promoting deeper understanding and knowledge retention.

Access to information is essential for developing independent learning and problem-solving skills (Fiteriani et al., 2021; Treffinger et al., 2023). The items "I can access information that helps me solve problems" and "I use information from outside my class for my schoolwork" assess students' ability to access and utilise information from different sources. Learner-centred pedagogy focuses on meeting the varied needs and interests of students. This is supported by learner-centred pedagogical theories like constructivism (Bremner et al., 2022). The item "I help to decide what to do at school" measures the degree of student involvement in their own learning process.

Self-paced learning allows students to progress at their own speed, accommodating different learning styles and paces (McClure & Williams, 2021; Tullis & Benjamin, 2011). The item "I work as fast or slowly as I like in class" assesses the flexibility of the Learning Environment in accommodating individual learning paces. Providing adequate support is essential for student success, as informed by Vygotsky's concept of the Zone of Proximal Development (Vygotsky, 1978). The item "I am given help to learn" measures the availability and effectiveness of support provided to students.

Collaborative learning enables student learning through social interaction and cooperation. The items "I share my ideas with a group I am working with" and "I show my work to my class" assess the extent to which students engage in collaborative and cooperative activities, establishing community and shared learning. As discussed in Chapter 2, ICT-supported learning integrates technology into pedagogy. The Technology Acceptance Model points out that perceived usefulness and ease of use influence ICT use (Sackstein et al., 2022; Venkatesh & Davis, 2000). The items "At school I use the internet to help me do my work" and "At school, when I am stuck, I can use the internet to help me move forward" measure the extent to which ICT is utilised to support learning activities and problem-solving.

Understanding *students' perceptions* of the difficulty of their schoolwork is important in tailoring support and interventions. The item "I find the things I do for school difficult" helps identify areas where students may struggle, enabling targeted assistance and adjustments in teaching strategies.

The construct of *enabling learning* focuses on creating an environment where students feel capable and supported in their learning. The item "I find it easy to work and learn at school" measures students' perceptions of the ease and effectiveness of their Learning Environment.

Adaptability is an essential skill that allows one to face changes and challenges in the Learning Environment (Feraco et al., 2023; Pertl, 2022). The item "I adapted to learning changes during COVID" assesses students' resilience and flexibility in response to disruptions, such as those caused by the COVID-19 pandemic.

3.6.1.1.2 Active Learning Using ICT

Active learning involves engaging students in activities that encourage analysis, synthesis, and evaluation (Carlos et al., 2023; Chance & Furlong, 2022; Patiño et al., 2023) and is a variable included in the model. The integration of ICT within Learning Environments, supports active learning by providing interactive and collaborative tools that improve student participation and engagement (Murphrey, 2010; Wekerle & Kollar, 2022). Theories of experiential learning suggest that ICT enables hands-on experiences and real-world applications, making learning more engaging, relevant and effective (Kolb, 2020; Lai et al., 2007). Therefore, measuring active learning using ICT helps in understanding the extent to which technology transforms interactive learning experiences (Newhouse, 2008b, 2014; Røe et al., 2022).

3.6.1.1.3 Attitude Towards ICT

Students' attitudes towards ICT play an important role in their willingness to engage with the Learning Environments that use ICT. According to the Technology Acceptance Model, perceived usefulness, and ease of use, influences individuals' attitudes toward technology and their subsequent usage behaviour (Alshammari & Rosli, 2020; Davis, 2023; Venkatesh & Davis, 2000). Positive attitudes towards computers are likely to lead to increased use of ICT for learning purposes, and may increase academic success rates (Chisholm, 2020). Therefore, assessing students' attitudes provides insights into their readiness and enthusiasm for integrating technology into their educational activities.

3.6.1.1.4 Distraction

While the use of ICT has many positives, it can be addictive and also can distract (OECD, 2023g). Distractions may come from sources such as social media notifications or entertainment websites such as *YouTube, TikTok*, etc, that are specifically designed to be attention-grabbing (Flanigan et al., 2023; Schuett, 2024). The Cognitive Load Theory (Sweller, 2020) suggests that extraneous cognitive load, such as distractions from non-educational content, can impede learning. Therefore, understanding the extent of distraction caused by ICT usage is important for developing strategies to mitigate its negative impact

and improve focus and productivity in Learning Environments (Flanigan et al., 2023; Kärki, 2024; Woo et al., 2024).

3.6.1.1.5 ICT Use Outside School

ICT use outside school provides insights into students' learning habits, highlighting that learning now extends beyond the traditional classroom. It has long been accepted that learning is influenced by environmental systems, specifically, the home environment (Piaget, 1973; Vygotsky, 1978). Students who frequently use ICT outside school are likely to develop better digital literacy skills (Lally, 2020), which can positively impact their use of technology for learning purposes within school (Millett, 2023). This variable helps in understanding how external ICT experiences may contribute to students' educational use of technology.

3.6.1.1.6 Age

Age is an important demographic variable that influences students' interactions with ICT. Developmental theories suggest that cognitive and social development stages vary with age, affecting how students perceive and use technology (Barrouillet, 2015; Piaget, 1973). Older students may have more advanced digital skills, and a better understanding of ICT compared to younger students. As students age, their use of ICT increases (Juuti et al., 2022). However, this increased usage outside of school is associated with higher levels of distraction (Hartley, 2022; Kärki, 2024). Thus, including age in the survey allows for the examination of developmental differences in ICT usage and its impact on learning.

3.6.1.2 Structural Equation Modelling

Structural Equation Modelling (SEM) was conducted using IBM SPSS AMOS to examine the relationships among the variables: Age, ICT usage outside school, Active Learning using ICT, Distraction, Attitude towards computers, and student perception of the Learning Environment. The aim was to understand how these variables interact to influence students' experiences with ICT in Learning Environments.

The decision to use SEM was informed by numerous studies that highlight the significant impact of ICT usage outside of school on students' comfort and proficiency with technology (Newhouse, 2008b; Santos, 2020; Shafik, 2024). These studies suggest that students who frequently engage with ICT outside of school are more at ease using it within school. This increased proficiency can lead to the effective use of technology for educational purposes, thereby improving the overall learning experience (Juuti et al., 2022; Newhouse & Clarkson, 2008).

Furthermore, the frequency of ICT use, and a positive attitude towards technology have been shown to significantly improve students' perceptions of their Learning Environment. Positive attitudes towards ICT are significant as they can motivate students to engage more deeply with digital learning tools, resulting in more interactive and engaging learning experiences (Juuti et al., 2022; Newhouse, 2015a, 2017). This is why both the frequency of ICT use and students' attitudes towards it were included as variables in the SEM analysis.

By employing SEM, this study aimed to provide a deeper understanding of these variables, and the relationships between them. The insights gained from this analysis are intended to inform the development of more effective strategies for integrating ICT into Learning Environments, with the aim of increasing student engagement, motivation, and learning outcomes.

3.6.2 The Interviews

Students, teachers, and principals were interviewed using three different sets of semi-structured interviews. This methodology was chosen to capture an understanding of the varied perspectives within the schools from the three groups of interviewees. The interview data was collected on-site at each of the NZ SDA schools. Each interview was designed to be about half an hour long but could be extended until the interview objectives were satisfactorily met. This time-frame was deemed appropriate, covering all relevant issues, and is within recommended optimal interview lengths of thirty minutes to slightly over an hour (Brayda & Boyce, 2014; Marshall et al., 2013; Thorsteinson, 2018). The interviews were semi-structured, enabling researchers to ask follow-up questions and seek clarification on

participants' insights, a method that has been successfully used by other researchers (Adams, 2015; Driscoll et al., 2007).

3.6.2.1 Student Interviews

The student interviews gathered data on students' perceptions and experiences with ICT integration in their Learning Environments. These interviews aimed to understand how students interact with technology in their Learning Environments, how they perceive the importance of their education, and how ICT impacts their engagement and learning outcomes. The interviews began with a request for consent to record the conversation and included questions about the students' year levels to contextualise their responses.

Students were asked to describe recent activities they found interesting, providing insights into the types of learning experiences that engage them. This was followed by questions on the use of ICT skills in these activities, allowing for an exploration of how technology is integrated into their learning processes. The students' views on the importance of education and their engagement with school activities were also examined, providing a deeper understanding of their educational motivations and priorities.

A major focus of the interviews was on the frequency and nature of ICT use at school. Students described their typical computer-based activities, which provided a snapshot of how technology is utilised in their daily learning routines. Questions regarding whether technology made school more interesting or important helped to gauge the impact of ICT on student engagement and perception of its relevance in their education.

Students were also asked about opportunities to share their work with others. This included exploring how technology aids in problem-solving, group work, and decision-making, reflecting the collaborative and interactive aspects of contemporary pedagogy. The interviews included specific scenarios where students solved problems using technology, which highlighted the practical applications and benefits of ICT in improving critical thinking and problem-solving skills.

The interviews addressed the perceived changes in teaching methods due to technology integration, providing a comparative perspective on traditional versus technology-enhanced pedagogy. Students' strategies for selecting important information during web searches were discussed, shedding light on their digital literacy and evaluation skills.

Students were asked about their experiences during COVID-19, focusing on how ICT supported their learning during remote education. This provided insights into the adaptability and resilience of students and the effectiveness of ICT in maintaining educational continuity during crises. Students were also encouraged to provide feedback and advice for their teachers, which may lead to improvements in ICT integration and pedagogical practices.

Overall, the student interviews aimed to provide an understanding of the role of ICT within the Learning Environment. The responses helped to contextualise the quantitative data collected through surveys and supported a deeper analysis of the effectiveness of ICT integration in NZ SDA schools. Appendix 3 provides a copy of the students' interview question.

3.6.2.2 Teacher Interviews

The teachers' interviews were designed to gain insights into the educators' aims, the integration of ICT in their teaching practices, and their perceptions of technology's impact on student engagement and learning. The interviews began with a request for consent to record the conversation.

Teachers were initially asked about their roles at the school and their tenure, providing context for their insights and experiences. This background information helped to situate their perspectives within their professional context. The interviews then looked at the teachers' main aims and objectives, investigating what they strive to achieve in their pedagogy. Teachers provided specific examples of activities conducted over the past term that illustrated how they were achieving their aims.

Over half of the interview focused on the use of technology in the classroom. Teachers were asked about the purposes for which students use technology and how these uses match with

the teachers' pedagogical goals. The discussion included whether the use of ICT had influenced the teachers' pedagogy and how ICT helps students engage with real-world contexts, develop collaborative skills, communicate effectively, experience differentiated learning, and build higher-order thinking skills.

The interviews also included questions related to the teachers' perceptions of student engagement and the strategies used to improve it. This allowed teachers to discuss how ICT helps students see the relevance of their subjects, connecting classroom learning with societal applications of technology. The interviews covered the teachers' assessments of their students' ICT knowledge and skills and whether ICT influences their assessment practices.

Further questions addressed the school's ICT infrastructure, including computer availability, the general state of the ICT network, the main software used, and the support teachers receive from the school to enable ICT use. Teachers were also asked about their professional development efforts to stay current with ICT knowledge and skills and anything else they wished to share regarding the use of ICT within their learning environment.

The interviews concluded with questions about the impact of technology on students' personal lives at home, the teachers' attitudes toward future ICT use, their experiences with remote learning during COVID-19, and lessons learned from the pandemic. This set of questions provided a thorough understanding of the teachers' perspectives on ICT integration in education. Appendix 2 provides a copy of the teacher interview questions.

3.6.2.3 Principal Interviews

The interviews of the principals (see Appendix 1) focused on understanding the current Learning Environments from an administrator's perspective. The interviews collected interview data on plans for ICT integration, the value of having a Curriculum ICT coordinator, the impact of BYOD policies, the strategies used to increase the effective use of ICT in supporting learning, and the impediments to effective ICT integration within schools.

Each interview began with a request for consent to electronically record the conversation. The principals were then asked about their roles at the school and their tenure, which

provided context for their responses and insights into their experiences with ICT implementation. Interview questions then explored the existing Learning Environments in their schools, providing a baseline understanding of how learning is structured and enabled. The interviews then examined the principals' perceptions of the impact that BYOD policies had on their schools, including both benefits and challenges. Principals shared the strategies employed during the year to encourage the use of ICT in learning, highlighting specific initiatives and their outcomes.

The interviews also had questions on the plans for promoting ICT use, giving insights into the schools' strategic directions and priorities. The value and importance of having an ICT coordinator were discussed, providing principals with an opportunity to reflect on how this role supports the effective integration of ICT within the respective schools. The final set of questions included those that asked principals to identify barriers to ICT integration. This provided opportunities to identify areas for improvement in the Learning Environments. The interviews concluded with an opportunity for principals to qualify or expand on any of their responses. Appendix 1 provides a copy of the principals' interview questions.

3.6.2.4 Interview Follow-ups

As the research progressed, it became apparent that the interview responses were becoming remarkably similar. This is in line with research that indicates that data saturation starts to occur after six interviews for small organisations (Guest et al., 2006). After the initial interviews, follow-up telephone and Zoom conversations occurred with seven participants to gain clarification.

Although formal interviews were not conducted with every staff member in the three schools, they were engaged in informal discussions about their use of ICT. These interactions provided direct insights into the everyday application and perceptions of ICT in the school environment, including supplementing the data with different perspectives and anecdotal evidence. Importantly, during these informal conversations, staff members nominated individuals within the school who were particularly knowledgeable or had experiences related to the research topic. This guidance helped in identifying interviewees who could provide in-depth information and insights, thereby improving the overall quality and

relevance of our research findings. These informal exchanges, therefore, played an important role in capturing the lived experiences and attitudes, adding depth and context to our research findings.

3.7 Data analysis

In the quantitative phase of this study, the students completed the questionnaires using *Survey Monkey*, and then the data was downloaded and formatted so that it was compatible with the SPSS 29, which is a commonly used statistical software application used in academic research (Hinton et al., 2014; Howitt & Cramer, 2020). Descriptive analysis for each of the items included in the questionnaire was conducted. Principal component factor analysis using SPSS was applied to each of the scales included in this study with a forced loading onto a single factor. Items that scored negatively were re-coded and items that loaded onto the factor with a score of less than 0.25 were discarded. The reliability of each scale was then calculated, and the reliability was deemed to be acceptable if Cronbach's Alpha was 0.7 or higher. A variable for each scale was then calculated.

Multiple linear regression was used to determine the strength of relationships between variables and standardised beta coefficients were calculated. In addition, the extensively used IBM SPSS AMOS version 29 structural equation modelling software (Collier, 2020; Thakkar & Thakkar, 2020), was used to calculate regression coefficients and also the co-variances in the model. Any variables that did not show significance were removed from the model, and a model fit score calculated the outcome variable.

In the qualitative phase of the research, thematic analysis was utilised. Braun and Clarke (2006) demonstrated a preference for thematic analysis due to its accessibility and flexibility in accommodating researchers. Their utilisation of thematic analysis comprised six steps, which were followed in this study during the analysis of the qualitative data. To begin, the researchers immersed themselves in the transcribed interviews, gaining familiarity with the textual data in the context of the research objectives. The transcripts were then imported into MAXQDA, a software specifically designed for mixed methods research that has been used in similar studies (Consoli, 2021; Rädiker & Kuckartz, 2020). Subsequently, the researcher

conducted the initial coding, labelling sections of textual data that held specific meaning pertaining to Learning Environments and the role of ICT in them. Figure 3.3 illustrates a sample of the initial codes developed in the MAXQDA software during the coding process.

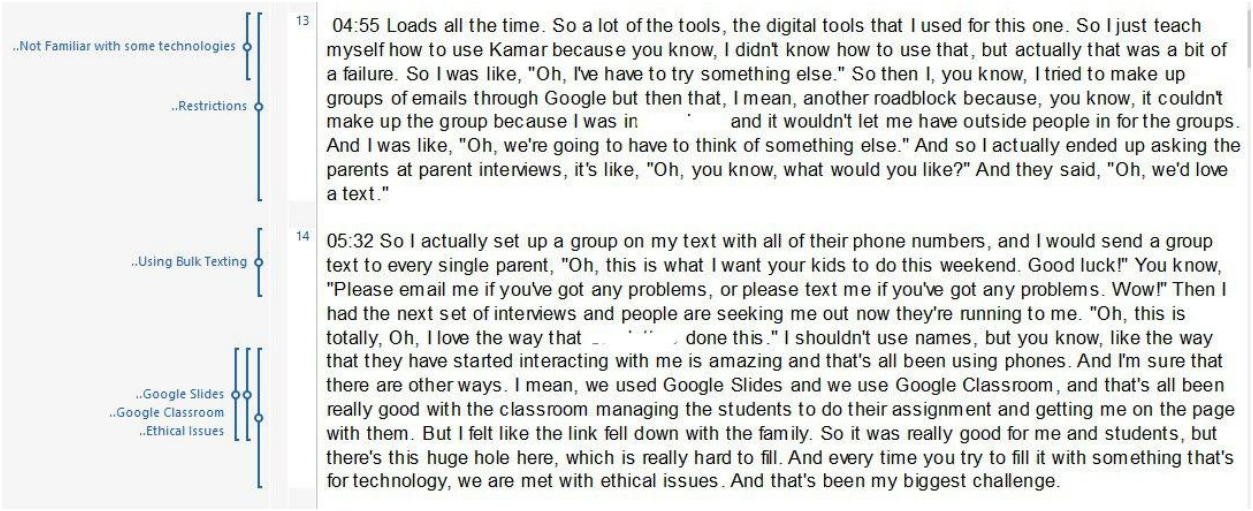

Figure 3.3 Initial Coding Sample for This Study in MAXQDA

In the third step, following the initial coding, the researcher proceeded to identify themes by grouping related codes. Once the themes were developed, the researcher moved on to the fourth step and reviewed them for adjustment. Subsequently, the analysis moved on to the fifth step, where final names and descriptions were assigned to the confirmed themes. Finally, thematic analysis results reports were generated for further analysis.

3.7.1 Transcription

Transcribing approximately twenty hours of interview data was a time-consuming yet essential part of this study. The process entailed meticulously listening to the interview recordings multiple times to accurately transcribe the spoken content. To ensure precision and clarity, follow-up phone and email conversations were conducted with participants to seek additional clarification where necessary. This rigorous transcription process formed the basis for subsequent analysis and interpretation of the qualitative data.

3.8 Ethical Considerations

This study strictly adhered to ethical standards established by the Avondale University Ethics Committee (NHMRC, 2018), obtaining the necessary approval to ensure the research was conducted in accordance with all necessary requirements. Ethical standards play an important role in research, safeguarding against potential negative impacts on participants (Greaney et al., 2012). This includes upholding privacy rights, preventing any form of harm, be it physical or psychological, and utilising the acquired information in a manner that benefits the participants (Resnik, 2001). These ethical guidelines were followed in this study.

3.8.1 Obtaining Consent

In this study, the ethical principle of voluntary and informed consent was strictly followed, respecting the rights and choices of the participants throughout the research process (NHMRC, 2018). Participants were given an informed consent form, which transparently outlined the purpose and benefits of the research. The consent forms guaranteed privacy and assured anonymity. In addition, the students were also given the autonomy to provide their own consent to participate in this research. Participation in this research was voluntary, and no participant was coerced into being part of this study. It was made clear to all participants that they had the freedom to withdraw at any point if they chose to do so.

3.8.2 Data and Information Privacy

In adherence to our commitment to the participants, all personal information, including individuals' names and the schools' names, was handled with utmost confidentiality. Anonymity was ensured by assigning participant identifiers instead of using their actual names. Furthermore, the interview data obtained from participants was securely stored and remained confidential. The transcription of the interview audio was undertaken by the researcher, with the aid of transcription and analysis software MAXQDA. This maintained the confidentiality of the interview data.

The transcription software utilised in this process adheres to a strict data protection policy, and has been certified with checks in place to safeguard data (MAXQDA, 2023). The same stringent privacy measures were applied to the survey data, which was collected and stored on the researcher's computer in a confidential manner. Each participant in the survey was also anonymised through the assignment of identifiers, therefore maintaining their privacy.

3.8.3 Physical and Emotional Safety of Participants

Ensuring the well-being of our participants was important throughout this study. Every effort was made to prevent any physical or psychological distress to the participants. They were informed that the interviews were consensual and that they had the right to decline to answer any question. Throughout the interviews, participants were at liberty to omit responses to questions they felt were sensitive or intrusive. A focus was maintained on the participants' emotional and physical safety, aiming to create an environment that encouraged openness and honesty.

3.8.4 Ethical Reporting

In reporting the research findings, an important concern was the anonymity of participants. No private information, such as names or locations was stored. Upon completion, only the anonymised transcript data will be stored in a confidential manner, preserving participants' privacy for potential future research. However, the original interview audio files were deleted from the researcher's computer to ensure no unauthorised access.

Chapter 4 Results and Analysis

4.1 Introduction

This chapter contains the results obtained in this study, which utilised a mixed-methods approach, combining quantitative data collected via a student survey with qualitative data gathered through semi-structured interviews. The quantitative survey findings are considered first as they shape the questions for the subsequent interviews. This approach provides a statistical basis that informs the qualitative insights. This sequential method enables the quantitative data to lay the groundwork and the qualitative data to contribute a depth of understanding. This methodology has been employed by other researchers (see Davies & Willing, 2023; El-Sabagh, 2021), and is utilised to achieve triangulation in the analysis (Dawadi et al., 2021; Ghiara, 2020; Haynes-Brown, 2022b).

The 324 students who completed the survey were spread across year levels seven to thirteen. Of the 34 participants involved in the semi-structured interviews, 4 were principals and 19 were teachers. The teaching experience ranged from beginner teachers to teachers who had 30 years of experience. There were 11 students who were in years eight to thirteen.

4.2 What is the nature of the Learning Environment in NZ SDA schools?

This section contains the findings with respect to the nature of the current Learning Environment within the three NZ SDA schools included in the study.

4.2.1 Students' Perception of the Learning Environment

The students' perceptions of the Learning Environment were canvassed first by a survey and then by a series of semi-structured interviews.

4.2.1.1 Survey Responses

The students were asked to respond to a series of activity statements about their school Learning Environment using a 4-point Likert scale (Mostly - 4, Often - 3, Sometimes - 2, Rarely - 1). The survey responses indicated the frequency of their participation in activities associated with a positive Learning Environment at their school. Table 4.1 reports the mean and standard deviation for each of the items, while Figure 4.1 illustrates the data in graphical form. Generally, student responses were positive about the Learning Environment, with most responses above the 2.5 midway point of the scale.

Table 4-1 Students' Perception of their Learning Environment

Item	Mean	SD
I do things at school that are good for me	3.21	0.761
At school I use the internet to help me do my work	3.19	0.840
I adapted to learning changes during COVID	3.05	0.947
I work as fast or slowly as I like in class	3.01	0.905
I can access information that helps me solve problems	2.99	0.867
At school, when I am stuck, I can use the internet to help me move forward	2.98	0.926
I do things at school that help me learn about the world	2.92	0.902
I do things in school that are relevant to my life	2.87	0.912
I am given help to learn	2.84	0.975
I find it easy to work and learn at school	2.82	0.871
I share my ideas with a group I am working with	2.81	0.908
I use information from outside my class for my schoolwork	2.73	0.964
The assessments I do in class are based on real world things	2.70	0.866
I am really interested in the things I do in class	2.51	0.921
I find the things I do for school difficult	2.42	0.881
I help to decide what to do at school	2.21	0.942
I show my work to my class	2.18	0.986

The activities that students reported the most frequent use were: I do things at school that are good for me (mean = 3.21, SD = .761), At school, I use the internet to help me do my work (mean = 3.19, SD = .840), I adapted to learning changes during COVID (mean = 3.05, SD = .947), and I work as fast or slowly as I like in class (mean = 3.01, SD = .905). The students report that they do these things often.

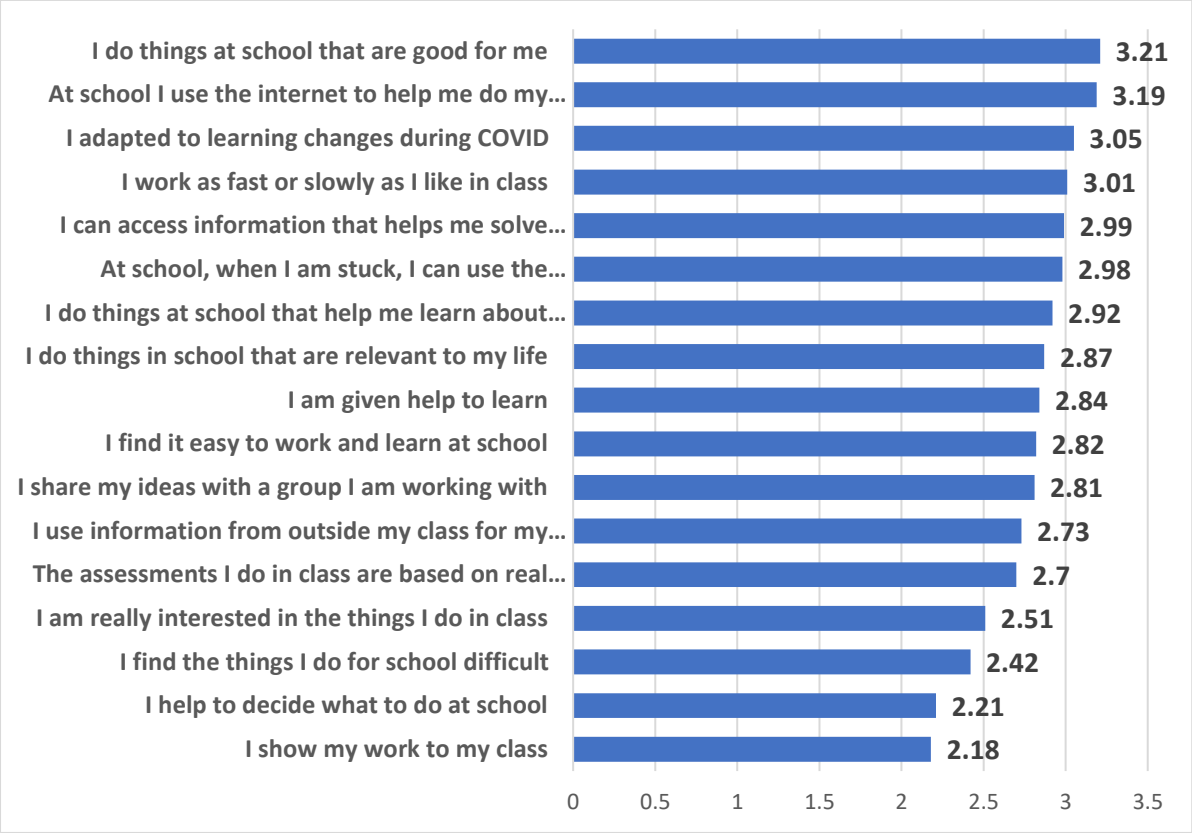

Figure 4.1 Students' Perception of Their Learning Environment

However, students reported less frequent use of some of the statements: I show my work to my class (mean = 2.18, SD = .986), I help to decide what to do at school (mean = 2.21, SD = .942), and I find the things I do for school difficult (mean = 2.42, SD = .881). Students report that they are most likely to do these things sometimes.

Factor analysis of all the Learning Environment Activities (Table 4) indicated that these items were loaded onto a single factor with a high reliability (α=0.89). This reliability score is statistically high and surpasses the threshold of what is considered reliable (Bonett & Wright, 2015; Croasmun & Ostrom, 2011). The mean score for the factor indicated that students often engaged in activities that contributed to a positive Learning Environment at their school (n=324, μ=2.81, SD=0.56).

An examination of specific clusters within the factor provides deeper insights into student engagement patterns. By analysing these groupings, we can better understand how students interact with aspects of their Learning Environment. This breakdown allows for an in-depth interpretation of the data, highlighting strengths and areas for improvement in the Learning Environment. These clusters provide information for identifying elements that contribute to or hinder the overall positive Learning Environment as reported by students.

4.2.1.1.1 Cluster 1: Beneficial and Relevant

Student responses to the following five items relate to their perception of whether schooling is relevant and is helping them in life.

I do things at school that are good for me (mean score 3.21)
I do things in school that are relevant to my life (mean score 2.87)
I do things at school that help me learn about the world (mean score 2.92)
The assessments I do in class are based on real-world things (mean score 2.70)
I am really interested in the things I do in class (mean score 2.51)

Overall, the collective mean of these items is 2.84, which indicates that students have a positive, but not overwhelmingly strong, perception of the relevance and life-applicability of their schooling. The responses suggest that while students appreciate aspects of their education that they perceive as beneficial, relevant, and have real-world applications, there appears to be room for increasing the overall relevance of school experiences.

These findings are in agreement with research on the importance of making learning relevant to students' lives to improve motivation and engagement (Brown et al., 2020; Dubey et al., 2023). There is extensive research, which includes the NISS framework and the Quality Teaching Model discussed in detail in Chapter 2, that supports the idea that when students see clear connections between their schoolwork and real-world applications, they are more likely to be engaged and motivated to learn (Gore et al., 2023; Newhouse, 2008b).

4.2.1.1.2 Cluster 2: Proactive Use of ICT

The next cluster of items asks students to evaluate how ICT is integrated into classroom activities and the subsequent impact on their Learning Environments

At school, I use the internet to help me do my work (mean score 3.19)
I can access information that helps me solve problems (mean score 2.99)
I use information from outside my class for my schoolwork (mean score 2.73)
At school, when I am stuck, I can use the internet to help me move forward (mean score 2.98)

These items collectively have a mean score of 2.97. For each of the items, the mean score is above the mid-point of the scale (2.5), indicating there is *proactive use of ICT* in school Learning Environments. The high score for 'using the Internet to assist in schoolwork' (3.19) indicates that students often use digital resources for academic purposes. This agrees with studies that highlight the growing importance of the Internet in Learning Environments (OECD, 2023b; Yeşilyurt & Vezne, 2023). This is further supported by the mean score of 2.99 for 'accessing information to solve problems', suggesting that students often use the internet as a tool for critical thinking and problem-solving. These are essential components of 21st-century skills (Erstad & Siddiq, 2023; OECD, 2021e; World Bank, 2021).

4.2.1.1.3 Cluster 3: Autonomy and Collaboration

The cluster set of items associated with autonomy and collaboration, reveals that students showed varied levels of autonomy and collaboration in their learning tasks. These items collectively have a mean score of 2.55.

I help to decide what to do at school (mean score 2.21)
I work as fast or slowly as I like in class (mean score 3.01)
I share my ideas with a group I am working with (mean score 2.81)
I show my work to my class (mean score 2.18)

The mean scores of 2.21 for 'I help to decide what to do at school', and 2.18 for 'I show my work to my class', are both below the mid-point of the scale (2.5). This indicates that students participate in such activities infrequently. It also suggests that students may feel

they have limited agency in decision-making and in sharing their work with the class. This may be an area where student participation and involvement in the classroom could be improved. Encouraging student voice and choice in educational activities is often linked to increased engagement and ownership of learning (Marín et al., 2020; Stenalt, 2021; Taub et al., 2020).

Conversely, the score of 3.01 for 'I work as fast or slowly as I like in class', indicates that students often do this, reflecting a positive view of student autonomy in managing their learning. These types of Learning Environments often include differentiated learning (Tomlinson & Imbeau, 2023) and individual learning styles (Lindner & Schwab, 2020; Tomlinson & Imbeau, 2023). The score of 2.81 for 'I share my ideas with a group I am working with' suggests students often engage in collaborative work. This is a major component of social learning theories (Jonassen & Land, 2012; Vygotsky, 1978), and indicates an environment that helps develop peer interaction and cooperative learning (Wang & Wu, 2022).

4.2.1.1.4 Cluster 4: Adapting to Challenges and Assistance in Learning

The final cluster of survey results reveals a perspective of the students' academic experiences associated with ease of learning, adapting to challenges, and assistance in learning.

I find it easy to work and learn at school (mean score 2.82)
I find the things I do for school difficult (mean score 2.42)
I am given help to learn (mean score 2.84)
I adapted to learning changes during COVID (mean score 3.05)

These items collectively have a mean score of 2.78. The mean score of 2.82 for 'I find it easy to work and learn at school' suggests that this is often the case for students, and they are positive about this part of their learning experience. This is supported by the score of 2.42 for 'I find the things I do for school difficult', which indicates this is sometimes the case for students, but overall, they find their schoolwork adequately challenging. This may be the result of personalised instructional strategies (see Bernacki et al., 2021; Humble & Mozelius, 2021).

Regarding the support provided in class, students reported a mean score of 2.84 for being given 'help to learn', which reflects that this is often the case for them. This finding corresponds with research on the provision of adequate support for students having a direct influence on learning outcomes (Bobis et al., 2020; Ventura, 2020). However, this finding warrants a deeper examination of the nature and quality of support provided because the effectiveness of learning support is contingent on its ability to meet student needs and learning styles (Reynolds, 2022).

The adaptability of students to learning changes during COVID-19, with a score of 3.05, reflects that this was often the case for students and shows a high level of resilience in the face of unprecedented educational disruptions during the COVID-19 pandemic. This adaptability is a reflection of students' flexibility and of the educators' ability to rapidly adapt and restructure educational delivery (Ofori Atakorah et al., 2022; Reimers, 2022b).

4.2.1.1.5 Cluster Summary

The students' overall perception of the Learning Environments in their school was positive (mean response of 2.81 on a 4-point scale). They perceived that most often in their school students were proactive in their use of ICT (mean response of 2.97). They appreciated that most school activities in their Learning Environments were beneficial, relevant, and matched with real-world applications (mean response of 2.84). Furthermore, they felt the school was providing them assistance in their learning and adapting to challenges in school life (mean response of 2.78). However, students identified areas for improvement around autonomy and collaboration within their Learning Environments, where the mean response was 2.55. Although this score is still positive, it suggests that students believe there is room for growth in agency over their learning and in increasing collaborative learning. Despite this, the overall responses indicate a favourable view of the Learning Environment provided by the school.

4.2.1.2 Interview Responses

Having obtained an overview of students' perceptions of the Learning Environment at their school through the analysis of the survey responses, 11 students were interviewed to gain an in-depth understanding of these perceptions. Thematic analysis codes were developed for the interviews through qualitative data analysis, structured into sub-themes and themes using the Reflexive Thematic Analysis (Braun & Clarke, 2019; Braun et al., 2023; Byrne, 2022).

Each of the themes that emerged from the student interviews will now be considered.

4.2.1.2.1 Theme 1: Students Are Motivated by the Way That Learning at School Sets Them Up for Success in Life

Students expressed that their learning was directly motivated by future aspirations. This theme emerged as a major finding in this study. The finding may indicate that when evaluating the Learning Environment, the students put significant weight on how the school supported these motivations.

Students specifically highlighted three significant motivations fuelling their enthusiasm for learning: their future careers, life skills, and achieving university grades. A significant driving force for their passion was the prospect of employment and a fulfilling career. Student 9 stated, "Because it's like a building block to whatever career you want to pursue in the future." Student 10 similarly emphasised, "So you can get a good job, I guess."

Another prominently expressed goal was the acquisition of essential life skills. Student 7 stated, "Because it sets up your life skills for the rest of your life, and what you learn here is what you're going to carry with you for the rest of your life." This highlights the students' perception that education is very important largely due to the practical life skills they could develop during their schooling years. Student 8 also stated, "It sets you up well for the rest of your life. It enables you to reach potential."

The aspiration to enter university served as a strong motivator for their passion for learning. Student 6 responded, "Because in order to get to university, to get good grades, so you have

to learn to get good grades." This illustrates the students' dedication to achieving good grades to secure university admission.

4.2.1.2.2 Theme 2: ICT Forms Part of the Learning Environment, But Its Potential Is Not Reached

Students had different experiences relating to the composition and availability of digital technology and the Learning Environment at their school. Student 9 stated that technology was ubiquitous at their school, stating, "... we use technology in every class that we take." This observation illustrates that some schools had already achieved a high level of ICT integration, where technology supported every class. Student 8 expressed, "And as technology is getting more advanced, I think the school is keeping up pretty well." In addition, Student 10 added, "... a few years ago we didn't use computers that much … so if it can change so much ...". These comments signify that these students perceive NZ SDA schools as making progress in incorporating ICT within their Learning Environments.

Furthermore, the students reported the schools' efforts to ensure equal technology access among students, regardless of their socio-economic backgrounds. The schools provided computers for loan to students who could not afford their own technology devices. Students could request a computer from the librarian if they did not possess one. These initiatives aim to create a level playing field as illustrated by Student 8, "They have computers they lend out to students who can't afford themselves as well. So, everybody has an equal opportunity." Student 9 added, "... if you don't have your laptop or iPad, you can just ask the librarian for a computer." However, Student 1 pointed out a significant gap in device availability, leading to a reliance on traditional methods like handwritten notes. This disparity in ICT access was further highlighted by Student 5's observation that even where devices were available, their use was limited. These students said that their lessons often did not incorporate ICT. They mentioned that many teachers skewed towards more traditional, notebook-based teaching methods.

Student 1's remark, "And then coming here, [it's] not really technology-based, it's more like notebook-based ...", highlights the contrast between expectations of a modern, technology-based Learning Environment and the reality of a more conventional/traditional pedagogy.

Similarly, Student 5's statement, "The problem with technology is we're only scratching the surface," suggests that even when digital technology is being used, its full potential is not realised. The issue of inadequate technology application is compounded by practical challenges like poor Wi-Fi connectivity, as indicated by Student 11's comment, "... but in some of the classes, the Wi-Fi doesn't connect."

4.2.1.2.3 Theme 3: Students and Their Teachers Do Not Always Prefer the Use of ICT over Traditional Methods

Students expressed a preference for traditional learning within the Learning Environment. Student 3 favoured physically writing notes in books rather than digitally typing them, stating, "Like, you know, just writing and stuff. Instead of typing on docs and writing a story on there. I like doing writing on books."

Students also indicated that some teachers were hesitant to use ICT in the Learning Environment. This included teachers who were reluctant to update their ICT skills. This reluctance, according to students, impeded learning. Some teachers preferred traditional teaching methods using textbooks. Student 5 reflected on this reluctance, "... get out of your comfort zone with technology. Like, especially all the older teachers who don't know anything ..." Student 7 also added, "Different teachers want to use books more than technology." Student 4 also provided insights into this matter, saying, "In some classes, we hardly use the computers. It's mostly reading and bookwork …", meanwhile, Student 11 highlighted a practical issue with technology, noting, "Sometimes the internet just doesn't work so we have to do other stuff".

4.2.1.3 Students Perspectives: Summary

Overall, the students had a positive view of their school Learning Environment. The data from the survey responses and the interviews indicated that there were three significant motivations driving their enthusiasm for learning within the NZ SDA school context: future careers, life skills, and achieving university grades. Schooling was viewed as a stepping stone towards their desired careers. Students valued its central role in having an influence on their future. The acquisition of essential life skills during their school years was considered

important, indicating a view of education that extended beyond academic achievement. The aspiration to gain admission to universities served as a strong motivator, highlighting their desire to do what it takes to maximise their chances of a rewarding career. The survey responses highlighted that these students perceived that their Learning Environment was supporting and enabling these aspirations, in that most of the learning activities were evaluated as relevant and beneficial, as found in cluster 1 analysis.

The students also highlighted the mixed pedagogical strategies used within the Learning Environment of their schools. They said that traditional methods of instruction were still used. However, ICT played a significant role in supporting their learning experience, and within their Learning Environment, there was significant assistance given to facilitate student learning across both methods of instruction. The use of ICT was seen as varied, depending on the lessons. This included the use of interactive software and online resources for research and self-study. The students said that ICT enabled a more interactive and engaging learning process, allowing for immediate access to a range of learning material that they would otherwise not have access to. The integration of ICT in their learning was perceived by the students as an enabler in developing digital literacy skills and preparing them for employment.

The students identified three main challenges accompanying the use of technology in their Learning Environment. A major frustration was the limited integration of digital technology across some subjects, leading to unsatisfactory learning experiences. They recalled that some teachers effectively and extensively utilised ICT while others relied on more traditional methods. This inconsistency created a disparity in the learning experience, sometimes making it difficult for students to gain the most out of ICT. Students pointed out issues such as inadequate access to necessary devices, occasional technical problems, and a lack of training for both students and teachers in effectively using ICT. These challenges highlighted the need for upskilling and support.

Students indicated that their Learning Environment provided limited opportunities for autonomy in their learning practices. The data suggested that most students felt uncomfortable sharing their work with peers, reflecting a school culture where collaboration was not prioritised. Collaborative efforts were mostly confined to idea-sharing in groups,

rather than more extensive forms of cooperation such as co-creating projects, peer reviewing each other's work, or working together on long-term projects.

Despite these challenges, students appreciated the opportunities for collaborative work, instant feedback, and the ability to study topics in greater depth through online resources. The findings suggest that while there is room for improvement, the current use of ICT already makes a significant contribution to students' learning experiences.

4.2.2 Teachers' Perceptions of the Learning Environment

In this section, we unpack teachers' perceptions of the Learning Environment within NZ SDA schools through the following themes that emerged from the teacher interview data.

4.2.2.1 Theme 1: Teachers Aim to Engage Their Students in Learning

The first theme to emerge from the data indicates that teachers recognise the importance of engaging their students during lessons. Teachers employ a variety of strategies to stimulate student interest that including the development of meaningful relationships with students, the incorporation of hands-on activities, and the encouragement of in-depth discussions.

A fundamental aspect of teachers' engagement strategy was building meaningful connections with students. For example, Teacher 11 illustrated this by stating, "When students feel valued, their investment in the learning process naturally deepens. It's about trust and mutual respect." This was emphasised most of the teachers and principals. They commented that the relationship between teacher and student forms the cornerstone of effective pedagogy, which is more than just the transmission of information.

In addition to relationship-building, teachers also placed significant emphasis on interactive teaching methods. Hands-on activities were frequently used to bring concepts to life, providing tangible experiences that reinforced theoretical knowledge. Teachers actively encouraged discussions, creating a classroom environment where open dialogue, critical thinking, and the exchange of ideas were encouraged.

Peer interactions were another significant element. Teachers viewed collaborative learning among students as effective, with the view that authentic engagement extended beyond individual interaction with technology. They spoke about group activities and peer-to-peer learning, recognising that these interactions can often yield deeper understanding and more meaningful learning experiences.

While acknowledging the benefits of incorporating ICT within their pedagogical practice, teachers believed in the irreplaceable value of human connection. They recognised that while ICT can provide innovative ways to transform learning, it should not overshadow the fundamental relationship elements of empathy, understanding, and personal connection. As Teacher 11 remarked, "Technology is a tool, not a replacement. True engagement almost always happens in the spaces between the clicks."

This highlights the teachers' commitment to balancing the use of ICT with the preservation of traditional, relationship-centred pedagogy. For these teachers, the NZ SDA school Learning Environment is one where positive teacher-student relationships are nurtured, hands-on activities are frequently used, and peer interaction is actively practised. It is an environment where discussions and critical analysis are encouraged. The teachers emphasised that while ICT is an effective tool, it is not a substitute for teaching. They said that effective pedagogy is fundamentally about building positive relationships and engaging students on a personal level. This reflects the balance that teachers strive to achieve between maximising the benefits of ICT and maintaining the essence of traditional, relationship-centred pedagogy (Benade, 2017; Verma & Soni, 2022; Young et al., 2019).

4.2.2.2 Theme 2: Authentic Learning Is Both a Goal and a Challenge for Teachers

The concept of 'authentic learning' stood out prominently in the interviews with teachers. They spoke about authentic learning as both an aspirational goal and a significant challenge. They explained that authentic learning emphasised the importance of real-world contexts and practical applications within their lessons. Furthermore, they emphasised its ability to deepen students' engagement and make learning more relevant and meaningful. However, despite its recognised benefits, teachers encountered numerous challenges in its effective implementation.

An obstacle highlighted by the teachers was the pressure to cover an extensive curriculum within stringent time constraints. For example, Teacher 9 voiced this concern saying, "The pressure to cover a vast syllabus within a limited time-frame makes it challenging, especially when an increasing number of students have special needs." This issue was particularly acute in subjects that included both external and internal assessments. Educators found it challenging to strike a balance between delivering theoretical content required for assessments and integrating real-world applications that make learning more authentic and engaging.

Teachers spoke about some students' inability to process real-world contexts at their current stage of development. Teacher 19 expressed doubts about their readiness, remarking, "I don't think their minds are ready to develop that kind of thinking at this age." To overcome this challenge, Teacher 19 adopted an alternative strategy by creating fictional scenarios featuring students' names as characters. This technique aimed to make concepts more relatable and easier to grasp, albeit at the expense of incorporating more genuine real-world scenarios that might have provided authentic learning experiences.

These challenges reveal the difficulties in implementing authentic pedagogy. According to teachers from all three schools, it is not easy to cover all the curriculum requirements and assessments while also providing learning experiences that are relevant and applicable to real-world situations, which are often more time-intensive. The ongoing struggle to achieve a balance between delivery factors suggests that while authentic learning is valued, its implementation requires careful consideration of the learning context and the developmental stages of students. In essence, while the teachers in this study value and strive for authentic learning, the realisation of this goal is hindered by practical constraints. These include the level of development of students which includes their capacity to engage with complex real-world scenarios and also their ICT capacity (Newhouse, 2008b). The Quality Teaching Model and the NISS framework both suggest that for authentic learning to be effectively implemented, there is a need for a balance between the intellectual demands of the curriculum and the students' capacity to meet these demands (Gore et al., 2023; Newhouse, 2008b).

4.2.2.3 Theme 3: Teachers Use Collaborative Learning Widely in the Classroom

Collaborative learning emerged as a prominent theme in the interviews, with a consensus among teachers that students often demonstrated greater levels of engagement, deeper understanding, and improved performance when they worked together. Teachers said that, under ideal conditions, collaboration drew on the collective strengths of the group, allowing students to benefit from one another, and making learning an enjoyable experience. Teacher 1 illustrated this by stating, "I think that they work better when you put them in groups. So, if you have a group and each member in the group has a job ... they all start talking and fixing and creating."

Teachers said that students effectively collaborated using technology. For example, Teacher 12 stated, "I do set tasks like that; collaborative ones where groups are working on the same things. It's quite useful. They're more used to that and using ICT does help them collaborate." The use of ICT also facilitates the open sharing of information among students, which was often observed to be lacking in traditional classroom environments. Teacher 1 described this transformation, noting, "There used to be a lot of secrecy around work, even from students. They were all very reluctant to show or share their work with fellow students. However, with the ICT-integrated classroom, students are now openly sharing with their peers." This shift toward openness and collaboration was seen as a positive development in the Learning Environment.

ICT integration extended to collaboration among teachers, enabling effective and efficient teamwork. Teacher 11 illustrated this aspect, stating, "We've got our shared drive, and all of that is done online. A lot of things are done online. Staff meetings are kept online now. It is more collaborative. We are thinking about the classroom and about how staff work together now. It's way more collaborative because the document goes up, and you put your bits in ..." This strategy among teachers reflected a holistic shift toward a more collaborative school environment.

Despite the widely recognised benefits of collaborative learning, its implementation in classrooms was found to be variable. Some teachers observed that true collaboration among students was often lacking, noting that the workload in group activities frequently fell on one

or two students, leaving others disengaged. For example, Teacher 12 remarked, "In many instances, what is intended as group work often ends up being where one or two students end up doing most of the work, while others are off task." This highlights a common challenge in collaborative learning, which is making sure that all students are equally involved, and that the workload is distributed fairly (Al-Samarraie & Saeed, 2018; Strauß & Rummel, 2020; Yang, 2023).

Overall, teachers view collaboration as an effective tool for improving learning, with ICT playing a significant role in facilitating both student and teacher collaboration. However, while collaboration was encouraged, it was often not successful. Despite this, the emphasis on collaboration indicates a commitment to creating an interactive and engaging experience for both students and teachers.

4.2.2.4 Theme 4: There is a Range of Integration of ICT in the Learning Environment of NZ SDA Schools

Teachers across the three schools included in the study recognised the important of role of ICT in their teaching environments. They employed a wide variety of software and hardware to improve the learning experiences of their students. As illustrated in Figure 4.2, these software applications included Google Classroom, Google Docs, Google Slides, and email, all of which are considered essential software. In addition, applications like Zoom and Google Meet were adeptly used to create virtual classrooms. This adaptation to remote learning and communication proved especially important in maintaining educational continuity.

Teachers also emphasised the enabling dimension of ICT in research and information retrieval, describing ICT as an indispensable component of their lessons. For example, Teacher 18 expressed this by stating, "In my class, it's basically finding information, doing research. The other classes may be different things, but for me, it is finding research, doing research, and finding information." This view was supported by other educators, reinforcing that ICT was often used for research-oriented tasks.

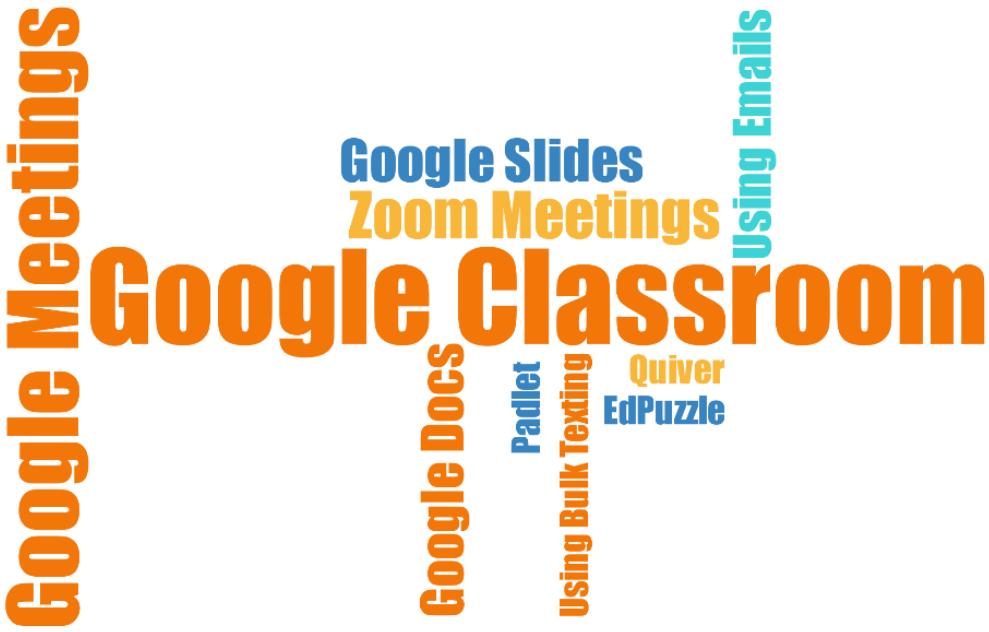

Figure 4.2 Software Identified in the Teachers' Interviews

Teacher 6 spoke about the transformative impact of ICT in broadening students' access to information beyond traditional school libraries. They observed, "The internet has made it easier for students to access a huge range of sources other than just our school library. It's about encouraging independent inquiry." This shift toward independent learning, enabled by ICT, has significantly enabled students' learning by allowing them to independently explore and engage with a variety of learning materials that they would otherwise not have access to.

Furthermore, teachers brought attention to the efficiency gains attributed to the use of ICT in education. ICT enabled efficiencies; for example, tasks such as data collection and research, which once took considerable time, could now be accomplished much more rapidly. "With technology, students can now gather data and findings in a fraction of the time it used to take," observed Teacher 4. This increased efficiency streamlined the learning process and provided learning opportunities to equip students with essential skills.

The teachers recognised that the Learning Environment was one in which ICT was most often adopted to gather information, and it enabled this gathering to be performed in an efficient manner. This type of ICT use by the students also influenced a shift to independent learning.

4.2.2.5 Theme 5: Teachers Aim to Tailor Learning to Specific Students' Needs

Teachers emphasised the importance of catering to different student needs because of the existence of different learning levels and preferences amongst students. Teachers spoke about the increasing need to be adaptable. All the teachers interviewed highlighted the value of employing a variety of instructional methods, and resources (both digital and analogue) to meet these different needs. For example, Teacher 11 emphasised the need to have a versatile repertoire of teaching strategies, stating, "It's about having a whole range of strategies up your sleeve. From apps, visual aids, hands-on experiments, and group discussions to independent assignments. You got to figure out what works best for the students."

Some teachers discussed using ICT to address the specific learning needs of their students, while also taking into consideration the disparities in learning levels. For example, Teacher 19 explained how they employed videos that cater to different learning levels to accommodate individual learning needs: "So, for example, I've got a learner who's learning at level one versus my level four learners who are at that level. So, I can have the same learning intention but use different videos or different resources to cater for their specific needs." Teacher 14 reported using videos to support students struggling with mathematics, allowing them to watch at their own pace for better comprehension. Teacher 18 supported this, stating, "Different students have different learning needs, and with technology, because some are slower learners, they can learn at their own pace, while faster learners can find more advanced information."

This theme highlights the commitment of teachers to addressing the wide range of learning needs of students within the NZ SDA schools. Teachers employ a wide array of strategies, and tools (both digital and analogue) to ensure that learning is personalised to individual abilities and requirements. This theme highlights the inclusivity within the Learning Environment, with ICT playing a part in facilitating personalised learning experiences.

4.2.2.6 Theme 6: The Goal of Learning is to Holistically Develop Students

Teachers mentioned that beyond the standard academic curriculum, they aimed to holistically develop their students through two additional dimensions in their teaching: the integration of beliefs and the encouragement of extracurricular activities. For these teachers, the concept of the 'Special Character' of their schools encompasses the spiritual and moral development of students. They viewed it as the core element of a well-rounded education. By incorporating Biblical teachings and examples into their regular lessons, these educators aimed to do more than just impart knowledge. Their goal was to nurture students into becoming morally responsible, spiritually aware individuals. Teacher 11 articulated this method, saying, "I try to incorporate Christian values into all my lessons because that is the most important thing long-term." Teacher 15 further emphasised the overarching objective of NZ SDA schools, which was to grow an enduring connection between students and their faith. They expressed, "The main aim does come down to the missional [missionary] one, and that's having kids leave here connected in a relationship with Christ."

This type of approach means that religious values were part of the learning and embedded throughout the curriculum, playing a significant role in the spiritual development of students. In other words, these elements were not supplements to the academic curriculum. They are an integral part of the pedagogy designed to develop the moral, spiritual, and physical aspects of students, thereby contributing to the holistic Learning Environment, which is a central aspect of Adventist Education.

4.2.2.7 Teachers' Perspectives: Summary

From the teachers' perspective, the Learning Environment in NZ SDA schools is one in which they actively promote student engagement by enabling meaningful student-teacher relationships. Discussion and critique are encouraged, and they aspire to implement relevant authentic learning. During the interviews, the teachers revealed that they face the difficult task of balancing the need to cover extensive curricula as they also try to provide learning experiences that are relevant and meaningful within real-world contexts. Teachers also contend with variations in levels of student readiness to engage with these real-world applications. This adds difficulty to the implementation of authentic learning methods.

The Learning Environment is seen by the teachers as one that supports collaborative learning and one where both traditional and ICT-focused strategies were utilised. Furthermore, teachers working within these Learning Environments are committed to adopting personalised pedagogy, thereby, catering to the different needs and learning styles of individual students. This adaptability was found to be often enabled by the strategic use of ICT, which allowed for a more personalised pace and style of learning. However, the teachers also recognised that ICT was often used to efficiently gather information, and this enabled a shift to independent learning.

4.2.3 Principals' Perception of the Learning Environment

This section is on the perspectives of school principals regarding the Learning Environment within NZ SDA schools. Four themes emerged from the analysis of the interviews with principals, providing insights into their perspectives.

4.2.3.1 Theme 1: NZ SDA Schools Have a Dual Focus

The principals interviewed highlighted that the Learning Environments in their schools have a dual focus on cultivating both faith and academic results. For example, Admin 2 spoke about tension regarding the compatibility of much of the content on the internet with the faith-centric ethos of the school. This was corroborated by Admin 1 and Admin 4, focused primarily on the nature of content and ideologies students might be exposed to. Admin 3, stated, "It worries me what messages our kids are starting to get ...". The comment highlights the difficulties in managing ICT use in a manner that is in line with the school's religious ethos. All the school principals emphasised the increasing need for careful selection and monitoring of digital content. They commented that being vigilant about digital content is important in maintaining the integrity of the school's moral obligations.

All the school principals spoke at length about the pressing issue of balancing contemporary pedagogical practices with traditional pedagogy. None of the school principals said that they were "anti-technology", and all viewed digital technology as becoming increasingly prevalent in their schools. However, what seemed a challenge was the task of integrating this

technology in a way that reinforces, rather than detracts from, the school's special character. For example, Admin 4 spoke about a balance, which was described as filtering content and actively seeking ways to use ICT for academic purposes only and practice faith-based teaching.

The principals collectively perceived their Learning Environment as one with a clear dual focus: developing both academic achievement and spirituality. According to the principals, this dual focus required one to be systematic, intentional and on guard. They said that trying to make sure that pedagogy contributes positively to both the academic and faith domains of student life was important. The careful selection and monitoring of digital content was also seen by the principals as essential, helping to create a Learning Environment where students can thrive academically while remaining grounded in their religious beliefs.

4.2.3.2 Theme 2: The Learning Environment Is Undergoing a Pedagogical Shift

The interviews with the school principals revealed a significant pedagogical transformation occurring within NZ SDA schools. This shift marks a move away from traditional, teacher-centred educational methods towards more collaborative and student-focused pedagogical models that incorporate ICT. Admin 3 described this transition as a fundamental change. They mentioned that teaching has evolved since the training many educators received in the 'pre-internet era'. For example, Admin 3 explained, "We are doing a lot of work in pedagogical shifts in just, you know, most of us trained in the eighties and, you know, it's shifted, and it's moved ... it's really about being collaborative. It's really about being able to facilitate and being the facilitator in the classroom." This statement indicates a significant change in the role of teachers, from being the sole source of knowledge to becoming facilitators of learning. Admin 1 and 4 described teachers as having a new role that is about imparting information, actively engaging with students, guiding their exploration and understanding of subjects. It also includes establishing a more interactive and participative classroom environment.

All the school principals described this pedagogical shift as reflective of educational trends that prioritise student engagement, critical thinking, and problem-solving skills. They said that implementation was not always smooth, namely because of teacher capabilities and

financial constraints. Overall, their schools are adapting their methods to create more participatory and engaging learning experiences. They also mentioned that they now recognise the different learning styles and needs of students. This enables them to create a more inclusive and effective Learning Environment.

In their view, the integration of ICT did more than just improve individual lessons, it redefined the Learning Environment, supporting the needs of contemporary learners, whom the principals described as digitally literate and more engaged when lessons incorporated ICT. In addition, by supporting self-directed learning and providing opportunities for personalised learning experiences, ICT was seen as an enabler of both academic success and life skills. Ultimately, the principals believed that ICT improved educational quality and empowered students to confidently engage with ICT, thereby equipping them with ICT skills that are increasingly viewed as indispensable.

4.2.3.3 Theme 3: Modern Learning Environments Incorporate ICT

Principals observed that the extensive integration of ICT is a defining feature of the Learning Environments within their respective schools. For example, Admin 4 emphasised the use of portable digital devices, such as iPads, which have become often relied-on tools in reinforcing learning concepts and increasing students' self-efficacy.

The employment of these ICT devices represents a significant shift towards more interactive and student-centred learning methods. Admin 4 elaborated on this integration, explaining, "So they use it just to reinforce the learning and to have things like Mathletics, loading stuff up into Google Classroom so children have some self-efficacy, like that kind of learning in that space." This comment illustrates how software like Google Classroom is being used to create an environment where students are encouraged to take initiative and responsibility for their learning. According to Admin 2 and 3, these online collaborative applications have streamlined communication between teachers and students and enabled independence among learners.

All the principals spoke about how ICT enabled students to manage their learning more effectively, track their progress, and more actively engage with learning. In addition, they

also spoke about how these technologies are transforming what is considered 'traditional classroom interactions', allowing for what they perceived as a more personalised and engaging learning experience for the students.

All the principals mentioned that the widespread use of ICT in NZ SDA schools indicates a strong dedication to preparing students for a future in which digital literacy is increasingly important. They mentioned that by integrating technology into the curriculum, their schools were equipping students with the skills and confidence to be successful upon leaving school. This strategy, according to the principals, is about using ICT to create a more inclusive and effective Learning Environment. The principals also highlighted that the incorporation of ICT is an important factor in improving educational quality and enabling student autonomy.

The principals collectively said that while ICT should not replace the fundamental role of teachers, its use in increasing student engagement, personalisation, and autonomy represents a paradigm shift. They viewed ICT as a significant driver and enabler in creating Learning Environments where students are active participants in their own learning.

4.2.3.4 Theme 4: Financial Challenges in the NZ SDA Schools Limit the Learning Environment

Financial constraints were identified as a major limitation on Learning Environments in schools. Admin 1 and 2 specifically pointed out the constraints brought about by budgetary restrictions. This reveals the practical difficulties that schools face in their efforts to modernise their Learning Environments. Admin 2 expressed this concern, "Budget constraints significantly limit our ability to hire the necessary technology support staff. Without adequate support, we can't really take advantage of its benefits." This comment highlights the direct impact of financial limitations on the school's ability to implement the Learning Environment of choice.

The financial challenges extend beyond staffing problems. For example, Admin 2 elaborated, "It's about having good staff … it's about updating our hardware, maintaining software licenses, and providing ongoing training for our teachers. All these elements are important … but they come with a cost that our current budget struggles to meet." These

insights from the school principals reveal the complex financial realities confronting NZ SDA schools in their pursuit of advancements within their Learning Environments. The inability to allocate adequate resources for staffing and learning needs highlights a challenge faced by many educational institutions. Balancing the desire to provide the latest in ICT-based educational software and hardware within the practicalities of budgetary limitations is a significant challenge.

Principals described the ICT dimension of the Learning Environment as variably supported by staff and somewhat adequate hardware and software. They also spoke about the importance of ongoing professional development for teachers, which they said was a success overall. Despite these positive aspects, they noted that tight budgets were a hindrance. As a result, the schools were 'hamstrung' in their ability to innovate.

4.2.3.5 Summary of Principals' Insights

The perspectives shared by school principals provide a description of the Learning Environment from their point of view. They highlighted that the Learning Environment was one with a dual focus, including both academic and faith development components. The principals indicated the Learning Environment was positively changing, with a pedagogical shift toward a collaborative model, where both teachers and students are actively engaged in the learning process. They emphasised the widespread integration of ICT within NZ SDA schools' Learning Environments. The principals in their interviews, however, often drifted into the aspirational rather than keeping to the description of their schools' Learning Environment. They were often keen to highlight the potential positive influences of ICT on learning and in developing student autonomy. Financial constraints were highlighted as a significant factor limiting advancements in ICT utilisation in the Learning Environment.

4.3 What Role and Impact Does ICT Play in Supporting Learning Environments?

Having considered students', teachers', and principals' perspectives on the learning environment, this section is on the students', teachers', and principals' views on the role of ICT within the Learning Environment.

4.3.1 The Students' Perspective on the Role and Impact of ICT

Understanding how students, who are the main focus of schooling, perceive the integration of ICT in their Learning Environments is important. This is because students' perceptions play a significant role in shaping the outcomes of ICT integration, influencing their engagement, motivation, and overall academic success (Cramarenco et al., 2023; Ertmer & Ottenbreit-Leftwich, 2010; Martin, Stamper, et al., 2020; Ottenbreit-Leftwich et al., 2023; Smart & Cappel, 2006). The following sections consider the quantitative data and then the qualitative data to investigate the impact of ICT on students' learning experiences.

4.3.1.1 Students' Perceptions through Quantitative Findings

The survey responses were the first source of data used to analyse the students' perspectives on the role and impact of ICT on Learning Environments.

4.3.1.1.1 The Use of ICT to Promote Active Learning

The students' perceptions of ICT's role in promoting active learning within the school environment were assessed quantitatively using seven specific items. These items evaluated students' use of ICT tools that promote active learning. The students' responses were collected on a 4-point Likert scale (Mostly - 4, Often - 3, Sometimes - 2, Rarely - 1). The responses for each of these items are listed in Table 4.2. The mean scores for the seven items range from 2.87 to 3.65, indicating a high level of engagement with ICT tools for learning purposes among students.

Table 4-2 Items Assessing ICT Tools in Promoting Active Learning

Item	Mean	SD
I have used a computer for learning	3.65	0.614
I have created or edited documents (e.g., to write stories or assignments)	3.51	0.746
I have googled for information to complete my work	3.51	0.724
I have created a slideshow presentation using (e.g., PowerPoint, Google Slides, Keynote)	3.45	0.807
I have used email to communicate with people	3.22	0.880
I have put information that I have found into spreadsheets or databases	2.89	1.033
I have made videos or sound recordings using devices	2.87	1.035

The high mean scores for items such as "I have used a computer for learning" (M = 3.65) and "I have googled for information to complete my work" (M = 3.51) suggest that ICT is integral to facilitating the seven learning activities in Table 4.2. These activities include the consumption of information and the creation and editing of documents. These are basic ICT skills which students are expected to possess (Alkema, 2023; Lewin & McNicol, 2015).

The use of ICT tools for independent research, as indicated by the mean score for googling information, points to the role of ICT in promoting self-directed learning. Items such as "I have used email to communicate with people" (M = 3.22) indicate that ICT tools also support the development of communication and collaboration skills. The lower mean scores for activities like "I have made videos or sound recordings using devices" (M = 2.87) and "I have put information that I have found into spreadsheets or databases" (M = 2.89) highlight potential areas where students may face challenges. These activities require more advanced technical skills, suggesting a need for additional support to help students effectively use these resources.

Using factor analysis, these items were loaded onto a single active learning factor with a mean of 3.30 and a standard deviation of 0.60, indicating a high reliability (α=0.84). This suggests that, on average, students frequently engage with ICT tools in ways that contribute to active learning.

4.3.1.1.2 Distraction Caused by ICT Use

To assess the extent of distraction caused by ICT use in the Learning Environment, students responded to four items. These items measured the degree to which ICT devices distracted them from their academic tasks. Responses were collected on a 4-point Likert scale (Mostly - 4, Often - 3, Sometimes - 2, Rarely - 1). The results for each item are shown in Table 4.3.

Table 4-3 Items Assessing the Distractions Caused by ICT Use in the Learning Environment

Item	Mean	SD
The use of ICT devices distracts me	2.77	0.920
The use of ICT devices takes away time I need to use for learning	2.61	0.935
The use of ICT makes me postpone my work	2.57	0.990
I spend too much time doing non-school activities (gaming, watching videos, etc) when I use digital devices	2.70	1.046

The results in Table 4.3, provide a different perspective on the role of ICT within the Learning Environment compared to the previous section. The mean values for these items range from 2.57 to 2.77 (M=2.66, SD=0.81), which is above the midpoint of the scale (2.5) and trending towards 3. These mean scores indicates that, on average, students do perceive ICT devices as distracting within the Learning Environment and for them this result puts them between sometimes and often. For example, the item "The use of ICT devices distracts me" has a mean of 2.77, which suggests that students are often distracted by ICT devices.

When comparing these mean values with those from the active learning section (Table 4.2), it becomes clear that students are more engaged with ICT in productive ways than they are hindered by its potential for distraction. The higher means for active learning items suggest that, overall, students find ICT tools to be beneficial however, they can also be distracting but less so. Using factor analysis, these items loaded onto a single distraction factor with a high reliability (α=0.85), with a mean of 2.66 and standard deviation of 0.81. Students report a moderate level of distraction but seem to manage their ICT use in a way that allows them to engage in active learning using ICT tools.

4.3.1.1.3 Students' ICT Use Outside of School

Students were also asked to reflect on their use of computers outside of school (e.g., at home) and indicate how frequently they engaged in nine activities on their devices. These responses were collected using a 4-point Likert scale (Mostly - 4, Often - 3, Sometimes - 2, Rarely - 1). The results for each activity are listed in Table 4.4.

Table 4-4 Items Assessing Students' ICT Use Outside School

Item	Mean	SD
Listen to music on the internet (e.g., Spotify, etc)	3.38	0.946
Watching downloaded or streaming videos (e.g., Netflix, etc)	3.21	1.010
Communicating with others using social media	3.19	1.028
Accessing the internet to find out about activities to do	3.12	0.919
Using the internet to get news about things I am interested in	3.11	0.926
Using voice chat	2.74	1.082
Reading reviews on the internet about things you may want to buy	2.72	1.104
Uploading photos or videos on social media	2.49	1.144
Posting comments on social media	2.47	1.114

The highest mean scores were associated with entertainment-related activities. "Listening to music on the internet" had a mean of 3.38, indicating that students frequently use their devices for streaming music through services such as Spotify. Similarly, "Watching downloaded or streaming videos" (mean = 3.21) was another highly rated activity, showing that video consumption, via services like Netflix, is also a common use of ICT outside school. These results suggest that digital media consumption is a significant aspect of students' lives outside the classroom.

Less frequent, but still significant, were activities related to consumer research and content creation on social media. "Reading reviews on the internet about things you may want to buy" had a mean score of 2.72, indicating that students occasionally/often engage in consumer research online. Meanwhile, "Uploading photos or videos on social media" (mean = 2.49) and "Posting comments on social media" (mean = 2.47) were the least frequent

activities reported. This suggests that while students are active consumers of social media content, they are less engaged in content creation and interaction.

Using factor analysis, these items were loaded onto a single "outside use" factor with a high reliability (α=0.88). The data reveals that students often use computers outside of school, with a mean response of 2.93 and a standard deviation of 0.74 on the 4-point Likert scale. This finding suggests that ICT plays a substantial role in students' personal lives, beyond its use in learning activities. The frequent engagement in a variety of online activities outside of school highlights the pervasive presence of ICT in students' daily routines, which has an influence on their learning, social interactions, entertainment choices, and information-seeking behaviour.

4.3.1.1.4 Students' Overall Use of ICT

Ten specific skills were assessed to gauge the overall proficiency of students in using computers. Responses were collected using descriptive statements and students' self-assessments. Skills that seemed challenging for students were identified, with over 20% of participants indicating limitations in these areas. The assessed skills and results were as follows:

Please Rate Yourself on Word Processing (Microsoft Word, Google Docs)

I cannot do much	7.7%
I can use fonts, type in words, check the spelling, and print	56%
I can make the page look good, add a footer and page numbers	42%
I can put in pictures, make tables, change the Page Setup, change margins	57%

Please Rate Yourself on Spreadsheets (e.g. Microsoft Excel, Google Sheets)

I cannot do much	25%
I can type in numbers	47%
I can make charts (graphs) and change them	40%
I can put in calculations, and add and delete rows and columns	36%

Please Rate Yourself on Slideshow Software (e.g. PowerPoint, Google Slides)

I cannot do much	10%
I can look at a slideshow and put in words, I can put pictures in a slideshow, and use fonts and layouts	41%
I can jump between slides when I show a slideshow	55%
I can add animations, transitions, and hyperlinks	59%

Please Rate Yourself on Email Use

I cannot do much	6.2%
I can read an email and send an email	58%
I can get my emails and use an Address book or Contacts List	39%
I can put messages in folders. I can find Sent and Deleted messages. I can create groups	56%

Please Rate Yourself on Computer File Management

I cannot do much	20%
I can save files in a folder, and look in different folders on the screen	44%
I can make new folders, and copy, get rid of and do new names for file	47%
I can see different file types. I can go to different drives and directories on the network, and I can use help files.	37%

Please Rate Yourself on Using a Web Browser (e.g. Internet Explorer, Google Chrome, Safari, Firefox)

I cannot do much	9.3%
I can use the Internet to click on links. I can go to a web site if I am told the address to type	45%
I can make a Favourite and can use a search	45%
I can save pictures and text from web sites. I can organise my Favourites and do and do advanced searches	64%

Creating Web Pages (Creating a Website)

I cannot do much	42%
I can make a web page with words and pictures	31%
I can put links in my web pages. I can change what my web pages look like. I can use different fonts	29%
I can put tables in my web pages. I can create links to other web sites and email addresses.	28%

Please Rate Yourself on Digital Photography

I cannot do much	9.9%
I can take photos or videos using a camera	55%
I can move my photos or videos to the computer	44%
I can look at photos or videos on the camera. I can adjust camera functions such as flash and close-up settings	55%

Please Rate Yourself on Image Processing

I cannot do much	10%
I can search and download images from the internet	55%
I can upload images to social media	40%
I can edit pictures, apply filters, and crop images	66%

Please Rate Yourself on Video Editing

I cannot do much	28%
I can move my videos on the computer	39%
I can delete parts of my video that I don't like. I can join my videos together	39%
I can put titles, transitions, and sound effects into my videos	52%

The findings from this section suggest that despite the common categorisation of these students as digital natives due to their age, their proficiency in ICT skills is not as extensive as might be expected. Instead of demonstrating a broad and evenly distributed range of ICT capabilities, students' expertise is concentrated in areas associated with more routine and commonly used tasks, such as basic word processing, web browsing, and digital

photography. For example, while many students are comfortable with simple tasks like typing in word processors or using a web browser to search for information, fewer students showed advanced skills such as spreadsheet manipulation, website creation, or video editing.

This indicates a significant disparity in students' overall ICT proficiency, revealing that their comfort with digital technology does not necessarily translate into ICT competency across more advanced software applications and processes. The uneven distribution of competencies highlights areas where students lack proficiency in tasks that require more advanced or specialised knowledge. This gap suggests that while students may be familiar with digital technology, their use tends to be more at a basic, consumption level rather than engaging with it in deeper, more complex ways. This reveals that there is a need to broaden their skill set so that they are equipped with a range of ICT competencies essential for academic and workplace success.

4.3.1.1.5 Students' Attitude towards the Use of ICT

To determine students' attitudes toward ICT, use in their Learning Environments, students were asked to respond to eight items. These items assessed the comfort, frequency, and perceived importance of computer use. The students' responses were collected using a 4-point Likert scale (Mostly - 4, Often - 3, Sometimes - 2, Rarely - 1), and average responses are shown in Table 4.5.

Table 4-5 Items Assessing Students' Attitudes to the Use of Computers

Item	Mean	SD
I am comfortable using computers for my work in class	3.69	0.633
I use computers at home	3.53	0.759
The work I complete using computers is important	3.50	0.684
Using computers has helped me to do difficult things	3.38	0.741
I make sure I am in class when we use computers	3.31	0.825
The work I do using computers is interesting	3.29	0.790
I try hard to finish work I do on computers	3.24	0.877
I can decide to use computers for my work	3.08	0.858

The item “I am comfortable using computers for my work in class” has the highest mean score of 3.69, suggesting that students feel confident and at ease when using computers for their schoolwork. With a mean score of 3.53, the item “I use computers at home” indicates that students use computers in the classroom and extend their use of digital technology to their home environments. The items “The work I complete using computers is important” (M = 3.50) and “Using computers has helped me to do difficult things” (M = 3.38) reflect students’ recognition of the value of ICT within the learning environment. These scores suggest that students perceive ICT-based tasks as significant and beneficial in helping them tackle challenging assignments.

Items like “I make sure I am in class when we use computers” (M = 3.31) and “I try hard to finish work I do on computers” (M = 3.24) indicate a strong level of engagement and commitment when ICT is involved. The item “I can decide to use computers for my work” has the lowest mean score (M = 3.08). This indicates that while students feel positive about using computers, and they often decide to use computers for their work, they may have less autonomy in choosing when and how to use them. This could reflect that the learning environment is overly structured, where ICT use is decided by teachers for specific tasks rather than by student choice.

Using factor analysis, these items were loaded onto a single “attitude” factor with satisfactory reliability (α=0.77). On average, students indicated positive attitudes toward computer use as part of their Learning Environment, as seen in a mean of 3.38 and a standard deviation of 0.48 on a Likert scale ranging from 1 to 4. This suggests that students held a favourable view of using computers at school. The data suggests that students have a positive attitude toward the use of ICT in their learning. They feel comfortable and engaged with digital tools, recognising and utilising them to complete academic tasks. However, the slightly lower mean score related to autonomy in using ICT suggests that there may be opportunities to give students more control over how they use ICT in their learning processes.

4.3.1.1.6 The Role of ICT on Students' Perception of the Learning Environment: SEM Analysis

As discussed in Chapter 3, the literature suggests that factors, including, students' general attitudes toward computers, active learning using ICT, distractions, ICT use outside of school, and age, influence students' perceptions of their Learning Environments. Drawing from the literature, a theoretical model was developed to investigate the potential relationships among these variables, as illustrated in Figure 4.3.

To test the proposed relationships, Structural Equation Modelling (SEM) analysis was applied to the theoretical model, which included external factors and attitudinal influences related to computer use. Initially, all factors were linked to the outcome variable, which is students' perception of the Learning Environment. Through an iterative process, pathways that did not have significant path coefficients were systematically removed. This followed the methodology of Byrne (2001); Jöreskog and Sörbom (1993), resulting in a final model (Figure 4.3) where all pathways were significant at the 0.05 level.

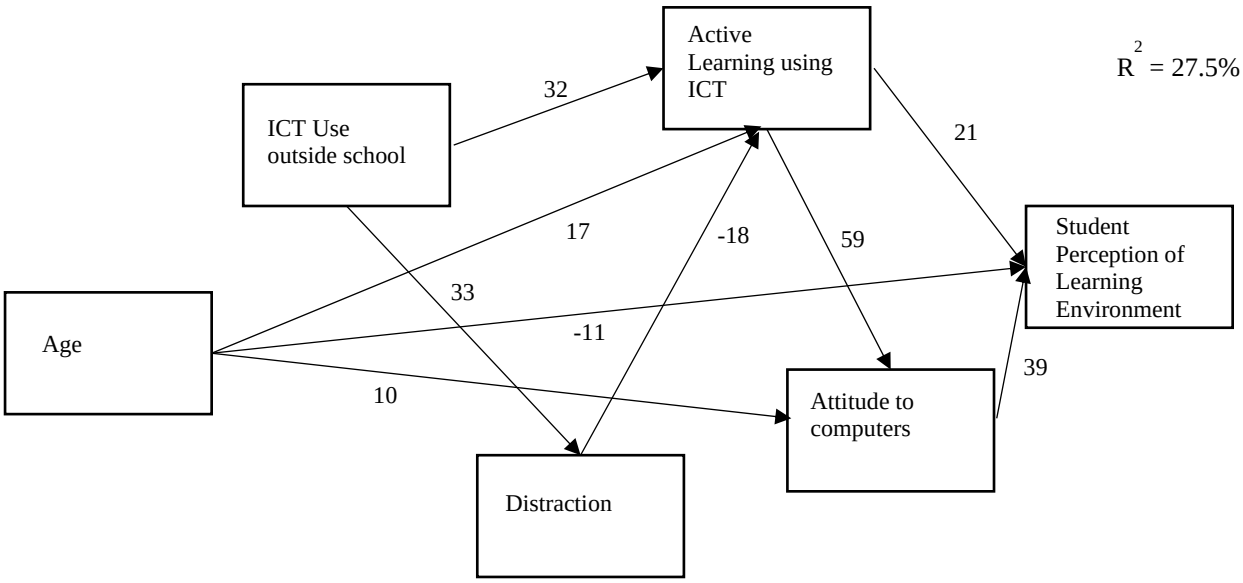

Figure 4.3 Structural SEM Results from IBM SPSS AMOS

The final model, as shown in Figure 4.3, accounts for 27.5% of the variance in students' perceptions of their Learning Environment. The model fit was evaluated using incremental fit indices, all of which indicated a good fit: [NFI = 0.991, RFI = 0.972, IFI = 1.005, TLI = 1.017, and CFI = 1.000]. The CMIN/DF value of 0.635 (with a CMIN of 3.174) and a root-mean-square error of approximation (RMSEA) of 0.000, along with a parsimonious normed fit index (PNFI) of 0.330, all suggest that the model fits the data well (Hooper et al., 2008).

The above model shows that the biggest influence on *Students' Perception of Their Learning Environments* is their *Attitudes Toward The Use Of Computers* (β=0.39). The more positive attitudes that students had toward the use of computers, the more positive their perception of their Learning Environments. This may be due to the use of ICT to help facilitate the learning activities in modern Learning Environments. If students have a positive attitude towards this ICT use, then they will have a more positive perception of the Learning Environment that is facilitated by ICT use. Their perception of their Learning Environment is also influenced by their active use of computers during learning activities (β=0.21).

In addition, the model indicates that the more students use ICT, the more positive their perception of the Learning Environment will be. There is a large indirect link between *Active Learning using ICT* to *Attitude to Computers* (β=0.59) and *Attitude to Computers* to *Students' Perception of the Learning Environment* (β=0.39). This indirect link (the equivalent to β=0.23 for a direct link) indicates that students who use technology actively in their learning have a better attitude toward computers. This made their perception of the Learning Environment positive.

The other direct link to *Student Perception of The Learning Environment* is from *Student Age* (β=-0.11), indicating that older students have a less positive perception of the Learning Environment. *Student Age* has a positive influence on their *Active Learning Using ICT* (β=0.17) and students' *Attitude To Computers* (β=0.10). Students' *Use of ICT Outside of School* plays an interesting role in their learning. On the one hand, it positively influences *Active Learning Using ICT* in the classroom that (β=0.32) but on the other, it also positively influences levels of *Distraction* in the classroom (β=0.33). This means that the more students use ICT outside of the classroom, the more distracted they can become when using ICT

inside the classroom. This distraction then has a negative influence (β= -0.18) on their active learning while using ICT.

The structured equation model indicates that the more students use ICT outside of school, the more comfortable they will be using the technologies and the more likely they are to use it in learning activities at school. This use will, in turn, increase their positive attitude toward the use of ICT. Both their use of ICT and positive attitude toward ICT positively impact their perception of the Learning Environment. This leads to students viewing the Learning Environment of the school as an environment that is facilitating their life progress. Students were found to use ICT more as they age. However, this use of ICT outside the school was found to influence their levels of distraction in using ICT. This, in turn, was found to negatively impact their ability to engage in active learning using ICT.

4.3.1.2 Students' Perceptions as Revealed in the Qualitative Data

The outcomes and relationships revealed through the analysis of the survey data were further investigated by analysing the student interview data. The three themes and their sub-themes, which emerged from student interviews relating to the roles and impact of ICT in the NZ SDA school Learning Environment, are presented below.

4.3.1.2.1 Theme 1: The Use of ICT Can Support Students' Learning

A main theme that emerges from the student interviews is that ICT may be used to support student learning. Each of the ways that were mentioned by multiple students during the interviews is presented as five sub-themes below.

4.3.1.2.1.1 Sub-theme 1: The Use of ICT Makes Learning Easier and Increases Productivity

Within the NZ SDA schools, the integration of ICT has streamlined the learning process for students, making learning easier and increasing student productivity. For example, Student 10 remarked, "... it's a lot easier to learn stuff online and write stuff down, and it just makes everything easier." This simplification of learning tasks allowed students to achieve more within a shorter time-frame, implying improved productivity. Student 2 emphasised this by

stating, “I definitely think that it increases my productivity just because I think you need something to reference, just to guide you, and I think the internet’s good for that.”

Students used technology for research to gather information on new topics or complete assignments. For example, Student 4 stated, “… you’re looking at information and websites basically for like an assignment I’m doing.” ICT-enabled hybrid and blended learning models allowed teachers to distribute materials online and subsequently discuss them in class. Student 2 highlighted this by saying, “I think now, like we said, they send us like copies of things online. Like they give us papers, but they also send us things online to work with.”

Lastly, digital technology was employed to facilitate assessments, shifting from traditional pen-and-paper assignments to digital submissions via services like Google Docs. For example, Student 9 illustrated this, “We use technology to receive homework. We don’t really get paper, like physical homework anymore. It’s just all digital.” Student 10 corroborated, stating, “Yeah, because with *Google Classroom* all set up you can do homework online, and a lot of the homework is online. So, like checking your email to see because the teachers will put the homework into Google Classroom then they’ll send you the email, so you know what homework you have.”

In summarising their experiences, students highlighted the significant role of ICT in their studies. They discussed ICT’s increasingly important role in facilitating and streamlining their learning process. The accessibility of digital technology was particularly emphasised, as it allowed students to complete their assignments flexibly, regardless of whether they were on school premises or off-site.

4.3.1.2.1.2 Sub-theme 2: The Use of ICT Helps Personalise Learning to the Student

ICT in the Learning Environment has significantly contributed to personalising learning, enabling more individualised learning experiences. This personalisation was found to be particularly important in Learning Environments where students had a wide range of learning styles and preferences. Student 8 highlighted this benefit, stating, “… it is very useful because everyone has a different learning style, and technology provides us with so many more options for different learning styles.” Similar points were expressed by other

participants, who commented on how ICT allows them to engage with content in ways that suit their personal preferences and pace.

For instance, many students spoke of how specific digital tools, such as educational apps (*Mathletics*) and online software applications (*Google Classroom*), provide multiple formats, such as text, video, and interactive simulations, that cater to visual, auditory, and kinaesthetic learners. In addition, according to students from all three schools, ICT enables self-paced learning. They explained that ICT allowed them to revisit materials, repeat lessons, and examine supplementary resources at their own pace. As Student 12 pointed out, "With the online resources, I can go back and review things as many times as I need to. It's really helpful because sometimes in class, I don't catch everything the first time."

ICT was also used to tailor learning by enabling personalised feedback. Students specifically mentioned software like Mathletics and Kahoot, which they found effective because it provided personalised feedback, helping them better understand their progress and areas for improvement. Collectively, it was found that ICT enables a Learning Environment where students can engage with the material in ways that are best suited to their learning styles, pace, and abilities, resulting in a more personalised and responsive learning experience.

4.3.1.2.1.3 Sub-theme 3: The Use of ICT Improves Learner Engagement

Students reported that the use of digital technology helped to increase their engagement. For example, Student 10 remarked, "I think it does help you to be more engaged." Student 2 supported this, stating, "I definitely think it's more engaging just because there's heaps on there." These students indicated that their engagement had improved due to the integration of technology into classrooms through gamification and interactive learning elements. This included using software such as Kahoot, injecting an interactive element into their studies.

In the classroom, ICT was employed in lesson presentations, utilising projectors to display digital content to supplement traditional teaching methods. Student 2 highlighted this engagement, stating, "... they, … it's more using the projectors and all that. So, when we're in class, they're talking … there are pictures and all that, and you can like, you're just listening to their voice." Furthermore, students also reported using technology to supplement

learning through videos, as pointed out by Student 8, “They show a bit more videos. They show videos now.” Most students reported that this use of multimedia was engaging for them.

4.3.1.2.1.4 Sub-theme 4: The Use of ICT Enables Collaboration

The use of ICT enabled collaboration among students in group work situations. For example, Student 9 highlighted technology’s role in simplifying collaboration with fellow group members, making group work effective. They explained, “I think technology helps it because whenever we work in groups, we have to share documents and everything. So, when we’re at home, and we want to finish everything, everybody can just kind of be there on the same document, and it’s like we’re at school, but we’re not. So, it makes it a lot easier. And we do use technology whenever we’re in groups.” Student 2 reported that by using digital devices such as phones for recording, they could multitask and collaboratively complete assignments, stating, “Yeah, a hundred percent. So, we did instead just our last assignment, we had to do multitasking, and we went in there with like a phone to like record-time and all that. So, the use of technology definitely played a big part in that assignment.”

The integration of digital technology in group work scenarios was seen to simplify communication and enable teamwork and cooperation. Students found that using online software such as *Google Classroom* and *Office 365* enabled them to work collaboratively, that is, share ideas freely, and combine their efforts effectively. This aspect of technology in education was particularly appreciated in the context of project-based learning, where collaborative skills are essential. For example, Student 3 explained that they would use a computer to collaboratively research their assigned group tasks, saying, “... there’s one computer like sharing between us, or I guess we could like all stay on that one computer and research like our things that we need as a group and make decisions and stuff.” Student 7 highlighted that the use of ICT tools made collaboration more effective and easier compared to collaborating without computers. “It does help a bit because it means you can work on the thing you’re working together on at the same time. Instead of having to pass the piece of paper around and take turns doing it, it’s going to take a lot longer.”

4.3.1.2.1.5 Sub-theme 5: The Use of ICT Helped Students Learn During the COVID-19 Pandemic

The students emphasised the central role of ICT during the COVID-19 pandemic lockdowns, which made at-home learning predominantly ICT-based. This transition enabled pedagogical models like 'flipped classrooms'. However, the flipped learning model was mocked by some students, for example, Student 7 stated, "Our teachers would, because we did this weird thing called Flip Learning ... it was kind of stupid to be honest because they're going to meet with us again anyway. But our principal was proud of it."

ICT within the Learning Environment during the COVID-19 pandemic enabled communication among students and between students and their friends or families. For instance, Student 1 mentioned using technology to communicate with friends who were physically distant during lockdowns, stating, "… just talking with friends I guess because you can't really see them." The students also used virtual conference applications like Zoom and Google Meets, forming the basis for virtual classes. Student 4 described their experience, saying, "I was like, I'll click this link to join the Google Meets and talk to teachers." Some students even expressed a preference for virtual learning compared to physical attendance in classes. Student 6 stated, "It was good for me personally. I would prefer being in my room and learning on Google Chats."

The Learning Environment during the COVID-19 pandemic was beset by five major problems. These included internet connectivity problems, distractions at home, limited communication, and ineffective pedagogy resulting in reduced student motivation. For example, Student 11 reported an issue with internet connectivity that impeded virtual learning, stating, "Just sometimes with many people on Wi-Fi, it lags a lot, so you can't hear on Google Meets and stuff very well." As Student 10 put it, "It was definitely a lot harder to actually learn during online classes and such."

Students also faced challenges related to limited communication in the Learning Environment during the pandemic. For example, Student 5 could not attend virtual classes as communication regarding the classes was not effectively conveyed, stating, "I couldn't really

get in my classes because no one gave me any emails to say, this is when you want me to be on. No one gave me that. Like, instructions were not given."

Students also reported that distractions were a problem when trying to learn from home. For example, Student 10 confirmed, "I feel like when you're home it's easier to get distracted." Students were also less motivated to learn at home during the pandemic. With the teachers out of sight, the students did not feel the pressure to focus on schoolwork. For example, Student 9 expressed, "I found it hard to do the work actually because you had nobody actually telling you [that] you should do it, encouraging you to do it." Student 2 also supported this, mentioning the lack of academic pressure due to the absence of physical teacher interaction. Stating, "I think a lot of people didn't get on well at that time in terms of like just getting the assignments done just because there wasn't, like, we weren't seeing our teachers physically, and so there wasn't the pressure of like, 'Oh, we have to do this and we have to do that.'"

4.3.1.2.2 Theme 2: The Use of ICT in Learning Can Increase Student Motivation

The use of ICT in the classroom was reported to increase student motivation through the way that it is used, and due to the way that it helps develop important 21st-century skills. Students reported that they use ICT for both personal and academic tasks. Students access technology by using devices, including computers, mobile smartphones, and cameras. For example, Student 6 commented, "We use it for like assignments and stuff, like we do assignments on the computer." Students report that learning activities were supported by software such as Google Classroom, Google Docs, and Google Meet. Students engaged with popular social media applications, such as TikTok, Facebook, Instagram, Snapchat, Discord, YouTube, and Pinterest, along with entertainment sources like Netflix, some of which can be used during formal learning activities.

Another student, Student 10, remarked, "When we use apps and websites that we're already familiar with from what we use to chat with friends, it makes schoolwork more interesting and fun." This highlights how using familiar software for academic purposes can increase student motivation. When students use devices and apps for academic purposes that they also use socially, they can be more motivated to work (Sabah, 2023; Yu et al., 2022). This use of

ICT in both personal and academic contexts helps to bridge the gap between pedagogy and everyday digital interactions, creating a more engaging and relevant Learning Environment.

Students said that they were more motivated to work when they were using and developing 21st-century skills, which they thought would be useful in the future. For example, Student 11 stated, "When we learn how to use different apps and websites that pros use, I feel like I'm getting ready for a real job." This highlights the intrinsic motivation students feel when they perceive their learning as directly applicable to their future careers.

The 21st-century skills that students mentioned can be grouped into three categories: Social Skills, Information Literacy, and Computer Literacy (see Figure 4.4). Social skills encompass the ability to communicate effectively, collaborate with others, and effectively participate in social networks both online and offline. Information Literacy involves the capacity to locate, evaluate, and use information efficiently, an essential skill in an age where information is abundant and easily accessible. Computer Literacy includes the ability to use ICT effectively, and the ethical use of ICT, with cyber safety at the forefront.

Social skills were found, evidenced by students' adept use of digital technology to communicate effectively with friends and family. Student 8 stated, "That's what I use to keep up with my family." Students also reported using information literacy skills, such as discerning the reliability of online information. For example, Student 2 explained, "We do this thing in history called reliability and usefulness. So, like when I'm searching up something, I have to go look at the website name, title, and then the author and then when it was published and then just how reliable that person is and like their qualifications." They were taught to identify credible sources. For example, Student 8 said, "Often the teachers will give us with a few links that we know are good because teachers have given to us. We've also been taught how to check if the sites are real or fake."

Students reported that the Learning Environment equipped them with essential skills such as coding and programming. Student 1 mentioned, "Sometimes we do coding," while Student 5 elaborated on activities involving computer hardware and software, demonstrating their ability to effectively use software applications: "Making a computer in Digitech … we are like updating the BIOS on it and like installing Microsoft."

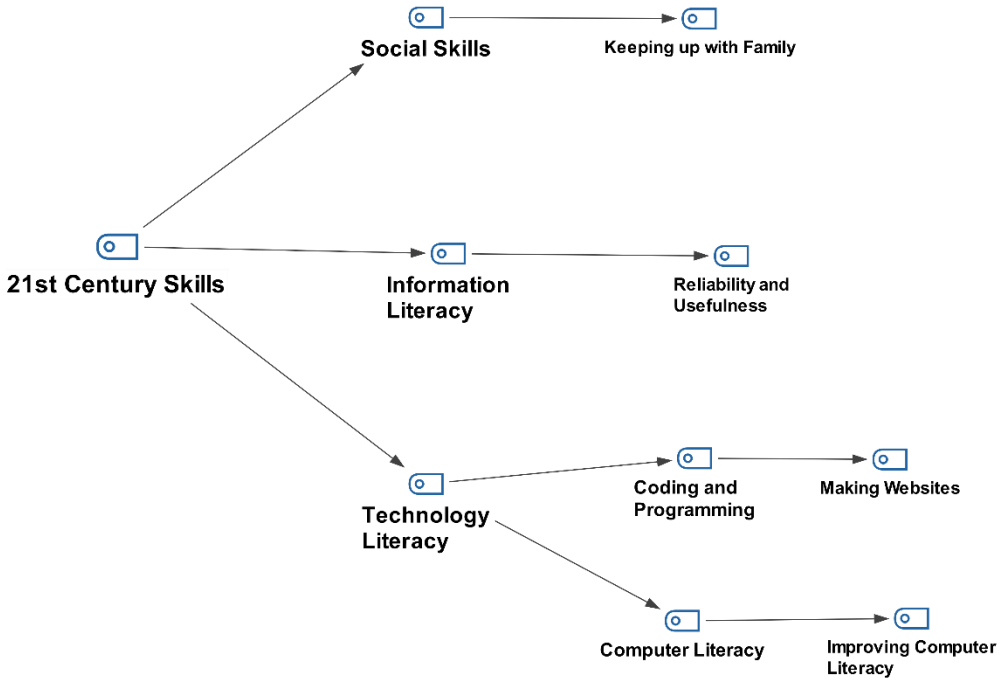

Figure 4.4 21st-Century Skills Acquired by the Students

The ability to create and manage online content was a recurrent theme. Student 5 mentioned creating websites in a structured environment, indicating skills in web development. These skills suit the demands of the 21st-century, where digital presence and online content creation are important. These activities encourage creativity, problem-solving, and critical thinking, which are essential skills for employment (Karaca-Atik et al., 2023; Ojetunde & Ramnarain, 2023; World Economic Forum, 2023).

Motivation is improved by the interactive and collaborative nature of many software applications. Students stated that they often feel more engaged when they can work together on projects using cloud-based collaborative platforms like *Google Workspace/Office 365* or participate in class discussions through online forums. This collaborative environment facilitates the establishment of community and shared purpose, which can be motivating. For example, Student 9 shared, "Working on group projects online makes it easier for us to share ideas and get feedback from each other, especially when some students are at home, which makes the work more fun." In addition, Student spoke about how they used the application *Discord* in their social studies class.

Using ICT effectively in learning allows for more personalised and self-paced learning experiences. Students appreciate the flexibility to learn at their own pace and revisit materials as needed. This autonomy in learning can significantly boost motivation as students feel more in control of their learning. Student 7 shared, "I like that I can watch videos myself and if I don't get-it the first time, I can watch it again or find another video that explains it better. It makes learning stuff easier."

4.3.1.2.3 Theme 3: ICT Can Have Some Negative Outcomes

While the use of ICT in the classroom can have positive outcomes (see Fisher, 2021b; Imms & Mahat, 2022), the students reported that it can also be associated with negative outcomes when ICT is integrated into Learning Environments without oversight.

4.3.1.2.3.1 Sub-theme 1: The Use of ICT Can Expose Students to False Information

A significant concern identified by students was the dangers associated with them encountering and accepting inaccurate information from the internet. The overwhelming volume and lack of regulation of online content creates a significant challenge in determining the accuracy and reliability of information (Soetekouw & Angelopoulos, 2024). Students struggled to discern credible sources from misleading or false ones. For example, Student 6 stated, "The majority of the time, I just think it's true because it's on the internet." This statement suggests a tendency among students to accept online information at face value, often without a critical evaluation of its legitimacy. This reliance on internet sources, without adequate verification or critical analysis points to a potential gap in digital literacy skills, specifically in the critical evaluation of online content. However, some students recognised that the content they were accessing at times was false. For example, Student 5 stated, "You sort of can tell its fake … like it feels dodgy and stuff. But it's sometimes hard to tell. Yeah, we haven't really been taught this stuff."

The impact of such unverified information on students' learning is that it can lead to misconceptions. The findings indicate that while students frequently turn to the internet as a main source of information for their academic work, they feel that there is a lack of emphasis on teaching them how to effectively evaluate the credibility of these sources. As ICT is an

increasingly central part of the Learning Environment, equipping students with the skills to be safe online is important. Educators need to focus on teaching students how to identify reliable sources and differentiate between fact and fiction online. This will help ensure that students engage in critical thinking and are capable of critically evaluating the credibility of their sources.

4.3.1.2.3.2 Sub-theme 2: The Use of ICT Can Cause Students to Become Distracted

The use of digital technology within the Learning Environment can cause students to become distracted. For example, Student 1 expressed frustration with these distractions and suggested that learning would be more efficient without ICT in the classroom, stating, "... it's more of a distraction than anything, more distracting than having no technology. Like if you had technology in the class, it's going to be a distraction. And I find that people who, when we have technology in the classroom, everyone's doing stuff on it other than schoolwork. So, I think if there was no technology in classrooms, it would actually make learning a lot more efficient."

Despite the potential of digital technology to aid learning, students said that they spend more personal time on their phones rather than utilising computers for schoolwork. For example, Student 2 expressed, "I think I spend a lot more time on my phone than I do on my laptop," while Student 1 explained, "I think most of it was for my own personal use and then like maybe, okay. Like maybe 85% was for my own personal use, and then the other percent was for schoolwork." These insights show students' inclination towards personal technology use over academic use, and how easily they can become distracted using technology.

4.3.1.3 Summary of Students' Perspectives

Students across all three schools said that digital technology has a positive influence on their learning experiences. They mentioned that their frequent use of ICT outside of school improves their comfort and confidence with technology. However, students also openly acknowledged that habits developed outside of school often lead to distractions during lessons.

During the interviews, students spent most of the time speaking of the advantages of ICT use. They specifically spoke about how technology enabled easier access to information, leading to increased productivity and an engaging learning process. The adaptability and versatility of ICT in catering to different learning styles were particularly emphasised, with students appreciating how these ICT-based tools could be customised to suit individual needs and preferences.

Students stated that a major role of ICT was to develop students' 21st-century skills, which they thought would be useful in the future. The 21st-century skills that students mentioned can be grouped into three categories: Social Skills, Information Literacy, and Computer Literacy. However, alongside these benefits, students were also aware of the disadvantages of ICT in the Learning Environment. Students were concerned about online content becoming a source of distraction. This observation highlights the need for careful and effective management of technology within the classroom to ensure that its use is focused on improving learning outcomes, rather than detracting from them. Overall, this finding highlights the importance of incorporating digital technology into pedagogical processes and doing so in a manner that is effective and conducive to learning.

The data also suggests that while students recognised the numerous advantages of ICT, they also acknowledged the need for a balance between traditional and modern pedagogy. According to the students, this balance involves using ICT in a way that supports different learning styles and does not overshadow traditional, yet effective, teaching practices. Students appreciated how ICT increases engagement and provides easy and fast access to information. They also valued the personal interaction provided by conventional teaching methods. In other words, they strongly suggested that ICT should be used in a way that complements rather than replaces traditional approaches.

Overall, the findings illustrate a complex but positive view of technology in the Learning Environment from the students' perspective. While the benefits of ease of access to information, heightened productivity, and improved engagement are apparent, the need for careful management and strategic integration of digital technology was also found in their responses. Figure 4.5 below summarises the roles and impact of ICT in the NZ SDA schools as reported by the students.

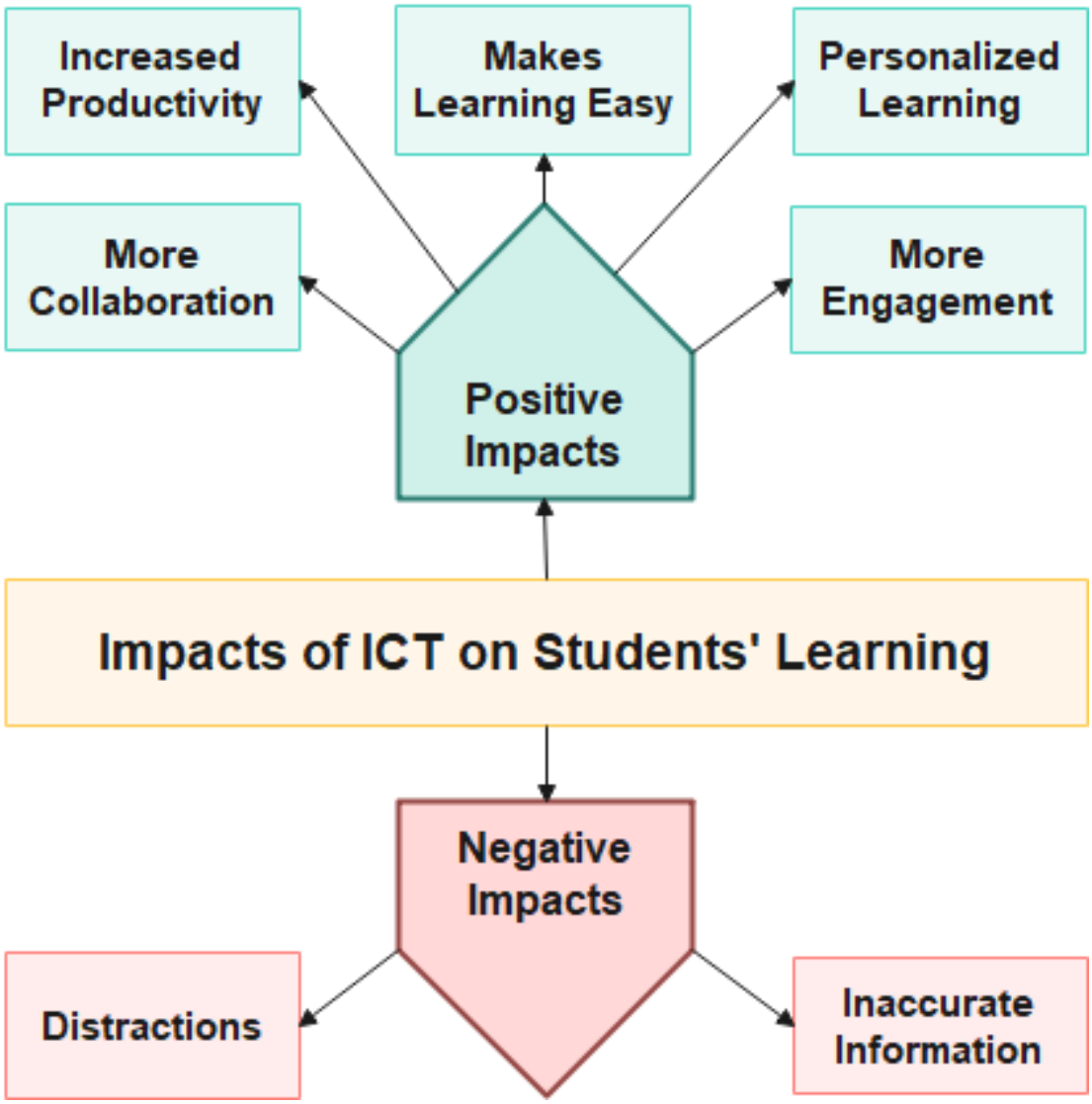

Figure 4.5 Impact of ICT According to Students' Interviews

4.3.2 The Teachers' Perspective on the Role and Impact of ICT

Teachers shared their perspectives on using ICT in the classroom in the interviews. Four themes, with underlying sub-themes, emerged during the analysis of the data:

4.3.2.1 Theme 1: ICT Is Viewed as Both Beneficial and Problematic to Learning

A common agreement amongst teachers was that technology has significantly influenced education within NZ SDA schools. For example, Teacher 1 confirmed that the use of digital technology had reshaped her teaching, while Teacher 9, an art teacher, pointed out how technology transformed student work in terms of reproduction and manipulation. Most teachers, however, have differing perspectives regarding the role of ICT within their Learning Environments. While some educators viewed ICT as a tool with a positive impact, others pointed out both positive and negative aspects of ICT use. In addition, others stated it is something that they rarely use.

According to teachers, the positive impact of ICT included personalised learning experiences, increased accessibility to information, making lessons more engaging, aiding in lesson planning, enabling effective communication between teachers and students, and assisting in classroom management. For example, Teacher 7 shared, "Using ICT has allowed me to customise lessons to fit individual student needs more effectively, making the learning experience more engaging for them." However, they also voiced frustration over potential negative impacts, such as distractions, excessive screen time, diminished problem-solving skills, dangers of using inaccurate information, and instances of academic dishonesty. Teacher 4 expressed, "While ICT can be a fantastic tool for learning, I've often noticed students can easily get distracted by non-educational content. I often catch them with hidden tabs, playing games which is so frustrating."

Five of the interviewed teachers viewed technology as 'just a tool' and were sceptical about its utility in the classroom. For example, Teacher 15 challenged the idea that technology fundamentally changes pedagogy, arguing, "Is that really changing pedagogy? I'd argue fundamentally no." These teachers emphasised the central role of teachers in effectively

engaging students, saying that ICT should be regarded as just one of the many enablers within the Learning Environment.

4.3.2.2 Theme 2: ICT Supports Students' Learning

Analysis of the teacher interview data highlights six categories of ways in which technology supports student learning, and they will be discussed as sub-themes below.

4.3.2.2.1 Sub-theme 1: The Use of ICT Improves Learner Engagement

Most teachers agree that the use of ICT improves learner engagement, particularly with respect to practical, hands-on activities. For example, Teacher 11 used a system where practical experiments precede theoretical learning and reported that this resulted in higher levels of student engagement. This method, supported by interactive learning activities that enable the use of technology, allows students to engage deeply with the material. As Teacher 11 notes, technology-enabled activities such as website building, actively involve students in the learning process, enabling greater hands-on participation and higher levels of engagement. Teacher 12 further highlights the importance of hands-on learning, specifically highlighting the role of ICT in engaging students in assignments involving website and database creation, stating, "The website and database assignments where the students create their own database, definitely." This practical engagement with technology is identified as a significant component of a quality Learning Environment that encourages students to be creative in solving problems.

The use of ICT, such as laptops, to access the internet, enables self-directed learning. This form of active learning enables students to take charge of their learning and grow, as illustrated by Teacher 7, who says, "… it's just giving them the tools so that they can use them and use it to help them grow in their learning." This autonomy in learning, enabled by ICT, is important in developing independent and critical thinkers.

Ten teachers passionately spoke of the transformative role of ICT in engaging students by making learning both enjoyable and interesting. For example, Teacher 1 stated, "You don't have time to make things cool and interesting. So, technology gives you a way to be able to,

you know, do that." Teacher 11 elaborated on the appeal of ICT within lessons, drawing particular attention to the differences in engagement compared to traditional teaching methods. Teacher 11 remarked, "… because it's fun, and it provides more than just a talk and talk …" Most teachers said that digital technology can transform the Learning Environment into one that is more engaging and effective.

Three teachers identified that the gamification of learning content is strongly engaging. Interactive games like Jeopardy and Kahoot make learning enjoyable and engage learners. For example, Teacher 3 observes that when using computer games, "… we can do something fun, and we can use it for the whole purpose of having some fun that's designed for the learning or for recapping or for whatever."

Teachers gave insights into how the use of technology in education made learning more accessible for special needs students. For example, Teacher 12 shared, "I've worked with a lot of special needs kids that have used devices and things to help, you know, with their learning. You know, kids who don't have the ability to hold a pencil and stuff like that. So, I've seen that work quite a lot. I would still agree with that." This perspective highlights how ICT can be particularly beneficial in supporting different learning needs, providing alternative ways for students to engage with, and access, learning material. The use of ICT in the classroom transforms the way information is delivered and broadens the scope of educational opportunities, making learning more inclusive and adaptable to individual needs.

To summarise, the teachers report that the use of ICT encourages active learning through self-directed activities, interactive experiences and hands-on practices. It was also found that gamification is a significant driver in maintaining and improving student engagement.

4.3.2.2.2 Sub-theme 2: The Use of ICT in the Learning Environment Facilitates Knowledge Construction

All teachers shared during the interviews the increasing role of ICT in facilitating knowledge construction. For example, Teacher 9 described technology as "… a wonderful tool for research and for finding reference material," indicating its role in enabling access to information during learning activities. Similarly, Teacher 11 drew attention to its value in

scientific studies, stating, “You can look up the latest research.” These perspectives highlight the role of ICT in enabling access to information that students would otherwise not have.

Teachers in the interviews highlighted how students utilise digital technology, especially with internet-based material, to manipulate, create and produce their own learning content. These are processes that facilitate knowledge construction. For example, Teacher 12 provided a description of this by explaining how students use ICT for different tasks, such as programming, website design, database creation, and graphic design, “So the students would use their computers for ... they’re creating their own information; programming, website design, database design, using Photoshop where possible. Making their own content.” This process of creating content enables students to construct knowledge actively.

To summarise, the teachers revealed that the integration of ICT within the Learning Environment is a significant driver in the process of knowledge construction. It enables engaged and self-directed learning, enabling students to turn information into knowledge in a way that is most suitable to them.

4.3.2.2.3 Sub-theme 3: The Use of ICT in the Learning Environment Facilitates Collaboration and Cooperation

All the interviewed teachers emphasised the integral role of ICT in increasing collaboration and cooperation. They mentioned that digital technology has significantly transformed the way that students interact, collaborate, and share knowledge, making the Learning Environment interactive and engaging. Digital applications, like *Google Classroom*, have become a hub for collaborative learning, enabling students to work jointly on group projects and assignments. For example, Teacher 17 explained, “Collaboratively, bouncing ideas off each other in the context of using technology is good. Obviously, the collaborative thing is *Google Classroom*, group assignments.” The use of technology has simplified the collaborative process for students. This has resulted in more teamwork and shared learning. The shift to online applications has made remote-based meetings and instant document sharing possible and has thus expanded the possibilities for collaboration that solves the problem of physical boundaries.

Teachers have also found technology particularly beneficial in facilitating collaboration with their colleagues. For example, Teacher 8 mentioned the utility of management tools for staff collaboration, "There are some management tools that I love to use in terms of collaboration with staff, we even use google classroom with teachers." This use of technology has streamlined communication among educators, facilitating efficient sharing of knowledge and technical resources and improving overall cooperation. Teacher 11 corroborated this, observing how technology has increased collaboration among staff members: "With technology, we are collaborating more. We're able to connect, share and work on documents in real-time, making our teamwork more effective."

4.3.2.2.4 Sub-theme 4: The Use of ICT Helps Personalise Learning to the Student

Teachers reported that using digital technology within the Learning Environment has significantly increased their ability to personalise and individualise learning experiences for students. They agreed that technology has facilitated differentiated learning, enabling teachers to customise their pedagogy based on each student's specific requirements. For example, teachers reported that they had used ICT to provide supplementary online resources, guidance for specific groups, and instructional videos. These support strategies enabled students, especially those needing additional support, to consume the learning material at their own pace, preventing them from falling behind in understanding the required concepts. Teacher 14 explained, "The thing that I have found useful with the technology is like when I'm teaching my Maths, there are videos on how to do long division. I can send some group away who really needs to watch it, they can slow it down." By using ICT in this way, educators can independently guide groups of students, who require focused attention on specific concepts, giving them the flexibility to slow down and thoroughly grasp the material.

By using digital technology to create personalised Learning Environments, teachers can use specific learning resources that support individual learning intentions and academic aptitudes. For example, Teacher 19 discussed how learners at different proficiency levels need distinct learning resources and the use of ICT enabled students, with varying learning capacities, to receive materials individualised to their specific needs. Teacher 12 also emphasised this strategy, saying, "So, for example, I've got a level learner who's learning at level one versus

my level four learners who are at that level. So, I can have the same learning intention but use different videos or different ... to cater for their specific needs."

The integration of digital technology has improved the way that learning can be personalised to the students' needs. Students can use ICT to progress through content at their own pace, utilising resources and content formats that cater to their needs and interests. Teachers report that this personalised dimension significantly improves the quality of the Learning Environment in NZ SDA schools.

4.3.2.2.5 Sub-theme 5: ICT Integration Improves Authentic Learning in the NZ SDA Schools

The increasing incorporation of digital technology into the Learning Environment has enabled educators to create authentic learning experiences in NZ SDA schools. Most of the teachers mentioned that the integration of ICT had facilitated authentic learning experiences, particularly around making classroom lessons applicable to real-world situations. For example, teachers shared the benefits of utilising the internet and computers to access real-world knowledge relevant to specific topics of interest. This gives students the chance to study current affairs, moving beyond the constraints of traditional textbook-based learning. They argued that traditional textbook information tends to be static and may quickly become outdated. For example, Teacher 4 explained, "Every student has a Chromebook in their room … I can go online to look up New Zealand health issues, as well as worldwide health issues, instantly. We can research anything that's written in a textbook. Textbooks are now obsolete."

Teacher 5 emphasised a similar idea on the necessity of preparing students in an increasingly digitised society. This preparation involves imparting the know-how to effectively cope with real-world issues using ICT "... tech is all around us. If, throughout their time here, they understand and become familiar with technology as an integral part of their learning and are trained to use it properly, then when they step into the outside world, they'll hopefully be safe." Teacher 5 added that due to the teachers' efforts in integrating technology into learning, students have become familiar with using ICT tools. The integration of ICT may result in authentic learning experiences in classrooms, bridging classroom learning

experiences to the real-world content. Teachers emphasised the efficiency of technology in accessing real-time information and preparing students for life outside of school.

4.3.2.2.6 Sub-theme 6: The Use of ICT Increases Inclusivity and Equity

The role of technology in promoting inclusivity was frequently discussed by teachers around its effectiveness in enabling students with special needs to succeed. For example, Teacher 7 shared, "… because he's borderline dyslexia, technology has significantly improved his learning and overall progress. When using pen and paper, it was extremely difficult for him to advance in his learning. But with the aid of technology, he can articulate his ideas verbally and have them recorded. That has made a significant difference." By utilising assistive technology, students with special needs can better express their ideas and engage in their education.

Teachers commented that the use of technology also significantly aids learners with special needs by simplifying the note-taking process. Instead of struggling to write down notes with pen and paper, these students can quickly capture information from the board using their devices. For example, Teacher 12 explained, "For students with special needs, taking a photo of what's on the board is much easier for them. While I still encourage others to write notes traditionally with a pencil or pen, the use of technology has allowed me to adapt my teaching methods to better meet the different needs of all my students, marking a significant evolution in some aspects of my teaching." Overall, teachers felt that the use of ICT has helped deliver educational equity, especially for students with learning needs.

4.3.2.3 Theme 3: ICT Use Improves Teachers' Ability to Support Student Learning

In the interviews, teachers reported that the use of ICT can improve teachers' ability to support students' learning. The theme is further broken down into three sub-themes, each highlighting a specific aspect of how ICT contributes to the teacher's role in supporting student learning.

4.3.2.3.1 Sub-theme 1: ICT Use Increases Teachers' Ability to Manage Learning

The interviewed teachers highlighted the organisational/administrative benefits that arise from the use of ICT. They recognised the role technology plays in structuring lessons and efficiently managing a variety of activities within the classroom. According to the teachers, the use of ICT made lesson planning efficient and organised. This resulted in creating more structure. For example, Teacher 19 provided insights into the practical applications of technology in classroom management: "I think it can be a tool for supporting in a classroom when you're trying to manage a variety of groups who are doing different things at once." Technology may be used to help teachers to simultaneously coordinate different learning activities and oversee and guide multiple student groups.

Teachers also commented on how the use of technology can help with lesson planning. For example, Teacher 14 stated, "… but regarding lesson planning, it does, it actually takes over a lot of my lesson planning, because those are prompts, they have timers on them, a lot of them as well for how much time we'll spend on that task. And all these things help you to structure your lesson. So that has a direct reflection on pedagogy in that regard, just the organising lesson." As indicated by the teachers, technology assists in the logistical aspects of lesson planning and influences pedagogy by providing structured time-frames and prompts for tasks. Software like Google Sites provides pre-designed templates, resource libraries, and interactive elements that aid teachers in creating engaging and well-structured lesson plans. This integration of technology saves time for educators, allowing them to focus on delivering quality instruction and less on administrative tasks.

To summarise, the teachers recognised the significant organisational benefits of using technology in their classrooms. It streamlines lesson planning, aids in managing different classroom activities, and contributes to more structured and effective teaching. The integration of ICT in Learning Environments simplifies logistical tasks for teachers and influences pedagogical methods, leading to a well-organised learning experience for students.

4.3.2.3.2 Sub-theme 2: ICT Use Facilitates Effective Communication

Effective communication emerged as another positive impact of the use of digital technology. The use of online applications promotes a more connected and interactive Learning Environment. For example, Teacher 15 added, "Doing them [lessons] online helps for ease of communication." Also, Teacher 8 stated, "And [it] allows students to go and research themselves and also communicate better." The use of technology can help with online communication between the teacher and the student and between the students themselves.

However, some teachers questioned the use of digital forms of communication. They emphasised the loss of meaningful communication skills due to the prevalence of text-based communication when using technology. They liked face-to-face interactions, expressing reservations about the effectiveness of online communication in enabling genuine connections and understanding among students. For example, Teacher 14 stated: "I think we've lost a lot of communication. They're losing the ability to have a decent conversation because they're so busy typing. I disagree with that. From a classroom sense, I don't want them sending messages across the classroom. I'd rather they actually spoke to someone."

These findings illustrate the dual nature of ICT's role within the Learning Environment. While it is obvious that ICT can enable communication by making it more accessible and convenient, the type of communication enabled by ICT may not always be the most effective for all situations. It is established that face-to-face interactions are more effective in developing effective student-teacher relationships (Redmond, 2011; Stevens et al., 2021; Topping, 2023). This suggests that while ICT enables easy communication, it should be balanced with opportunities for direct, personal interaction to ensure the development of communication skills. The varied perspectives among teachers highlight the need for a balance when integrating ICT within the Learning Environment, recognising both its benefits and limitations.

4.3.2.3.3 Sub-theme 3: The Use of ICT Helps with Assessment Processes

Teachers report that the integration of technology in the Learning Environment has advanced the assessment processes, especially in the context of remote learning. Software such as *Turnitin* has become useful for educators to tackle academic dishonesty by checking for plagiarism in students' work, which teachers reported was an increasing concern.

Furthermore, technology expedites the feedback process, a feature that students appreciated, especially during the pandemic when students often were in mandatory lockdown. For example, Teacher 11 expressed enthusiasm about how technology has made the assessment process more efficient. Students now receive real-time feedback on assessments, and this is a substantial improvement made possible through technology. This immediacy of feedback is important in guiding students and aiding them in their ongoing learning.

Teacher 16 supported this, speaking about the live feedback on learning management systems such as Google Docs. They specifically mentioned that it has been empowering for English teachers, enabling effective support for students in their academic progression. They mentioned, "Being also an English teacher, being able to give feedback to students as they're working with Google Docs has been probably a way bigger thing for us to carry on our shoulders as English teachers because there's always, 'Give me feedback, give me feedback,' and you can. And that live feedback and stuff has been really powerful to support students in next steps as opposed to waiting for summative assessments." Such real-time, interactive engagements illustrate how immediate feedback can contribute to creating a responsive and effective learning environment.

4.3.2.4 Theme 4: ICT Can Have Some Negative Outcomes

During the interviews, teachers reported three main challenges associated with the use of ICT in the Learning Environment. Each will be discussed as sub-themes in turn.

4.3.2.4.1 Sub-theme 1: Managing the Learning Environment That Includes ICT is Complex

Teachers spoke about classroom management being difficult in a hybrid learning environment. For example, Teacher 9 elaborated on the difficulties of using ICT to implement a hybrid learning model that combines in-person and online teaching, "... it places a lot of pressure on the teacher who's doing the hybrid model … We did a hybrid model where we taught a class and had students online as well. And it was a disaster." Teachers reported that it was difficult to coordinate and engage students effectively in a hybrid learning environment, where the demands of both online and offline teaching can be

overwhelming and lead to less-than-optimal educational outcomes. Teacher 1 added, "So I do find probably managing it, that's my biggest challenge. Sometimes it's, 'Come on guys, I can't trust you now. Get your books out. We'll just do it in the books' because I need them to be able to manage their own; what they're accessing, sending each other emails, or when we had Messenger. It just became a nightmare. So, although I love it, I find it difficult at times too." This statement reflects what other participants shared, that is, the struggle to strike a balance between the positives and negatives of ICT in the classroom. These findings show that some teachers are struggling with the management of the Learning Environment that includes the use of ICT.

The issue of excessive screen time was highlighted as a major point of contention for teachers. For example, Teacher 9 stated, "... kids have far too much screen time. They get so much screen time at school and then they just go home, and they also get so much screen time at home." This illustrates that the use of digital technology has become pervasive for some students and there is a struggle to maintain a balance.

4.3.2.4.2 Sub-theme 2: The Use of ICT Can Cause Students to Become Distracted

The use of ICT within the Learning Environments caused frustration among teachers, particularly regarding its ability to distract students. All the teachers interviewed shared experiences, indicating that ICT, although useful, often caused students to side-track from their academic tasks during activities intended to facilitate teamwork and communication. For example, Teacher 9 observed, "The technology can be a distraction and frequently is. I don't think that collaborative skills are always there. In fact, I think they often have a negative impact on collaborative skills, as students may be drawn to content that isn't useful or relevant to their current task." This perspective suggests that the allure of non-academic content on digital devices can work against educational goals and impede the development of essential collaborative abilities among students.

Some teachers expressed a strong preference for traditional, face-to-face interactions, which they believe help mitigate the issue of student distraction when ICT is being utilised. "I prefer face-to-face interactions because it significantly reduces distractions and enhances socialisation," stated Teacher 14. "In person, you can engage more naturally with students,

share jokes, and really get into meaningful conversations that help you understand them better. Online formats, lacking these personal interactions, don't result in the same level of connection. While it may be necessary for some situations, I find face-to-face interactions more effective for building strong, distraction-free educational relationships." Most teachers believe that in-person Learning Environments provide superior benefits, including reducing distractions and facilitating stronger connections with students.

Overall, while digital technology can improve learning, it can also result in digital distractions which can also impede the development of skills like face-to-face communication and collaboration. These findings suggest that a balance is needed between ICT-based and traditional methods of teaching and learning. This is of particular value to some students who have 'special needs' such as dyslexia or are autistic. Therefore, educators need to manage the use of digital technology in the classroom in a way that supports rather than detracts from the learning objectives and the development of interpersonal skills.

4.3.2.4.3 Sub-theme 3: ICT Can Result in Issues of Academic Integrity

Many teachers identified academic integrity as an increasingly relevant issue. They spoke about students' over-reliance on online sources for academic work. Teachers observed that students often resort to using information from the internet without engaging in thorough critical evaluation. Teachers found this concerning because of issues about the authenticity and accuracy of the material being utilised for academic purposes.

For example, Teacher 2 reflected on this concern, noting a shift in how students gather information for their assignments, "… probably would've assessed them on more variety before, but now they're just getting stuff off the internet to put in." This comment highlights the difficulties faced by educators in ensuring students do not solely depend on unverified internet sources. Similarly, Teacher 6 illustrated the 'double-edged' nature of technology as an information-gathering tool around its speed and efficiency in processing data. Teacher 6 stated, "I think the technology processes stuff very quickly and is a great information tool. So, it tells you stuff. And artificial intelligence, I've seen it will now try and prompt people to think, they'll give you the right questions. And they'll think, okay, this is getting people to think." This perspective highlights that ICT can facilitate critical thinking. It also points to

the need for students to develop skills in discerning, managing, and questioning the information they receive.

4.3.2.5 Summary of Teachers' Perspectives

Teachers reported that the use of ICT has both positive and negative dimensions. On the positive side, the integration of ICT within the Learning Environment was seen to facilitate personalised learning experiences. Teachers said that technology made information more accessible, rendering lessons both more engaging and enjoyable. ICT also played an enabling role in lesson planning, providing teachers with innovative tools to design and organise their instructional strategies more effectively.

Teachers reported that ICT integration significantly improved communication within the Learning Environment. This improvement was attributed to the ease with which both teachers and students could interact and share information, leading to a more connected classroom experience. Digital technology was seen as beneficial in classroom management, with teachers feeling that they could more easily manage student activities and maintain student engagement.

However, the findings also highlighted some negative impacts of the use of ICT within Learning Environments. Teachers were frustrated about students being digitally distracted. They observed students engaging in unhealthy amounts of screen time. This overexposure to screens was viewed as detrimental to students' overall well-being. Another negative impact was the decrease in opportunities for students to develop problem-solving skills, as technology can sometimes give quick solutions, bypassing the process of critical thinking and analysis. Furthermore, academic integrity was flagged as an issue, with easy access to information online sometimes leading to plagiarism and a lack of originality in students' work. Figure 4.6 below visually summarises the teachers' perceptions of the impact and roles of ICT integration within the Learning Environment of NZ SDA schools.

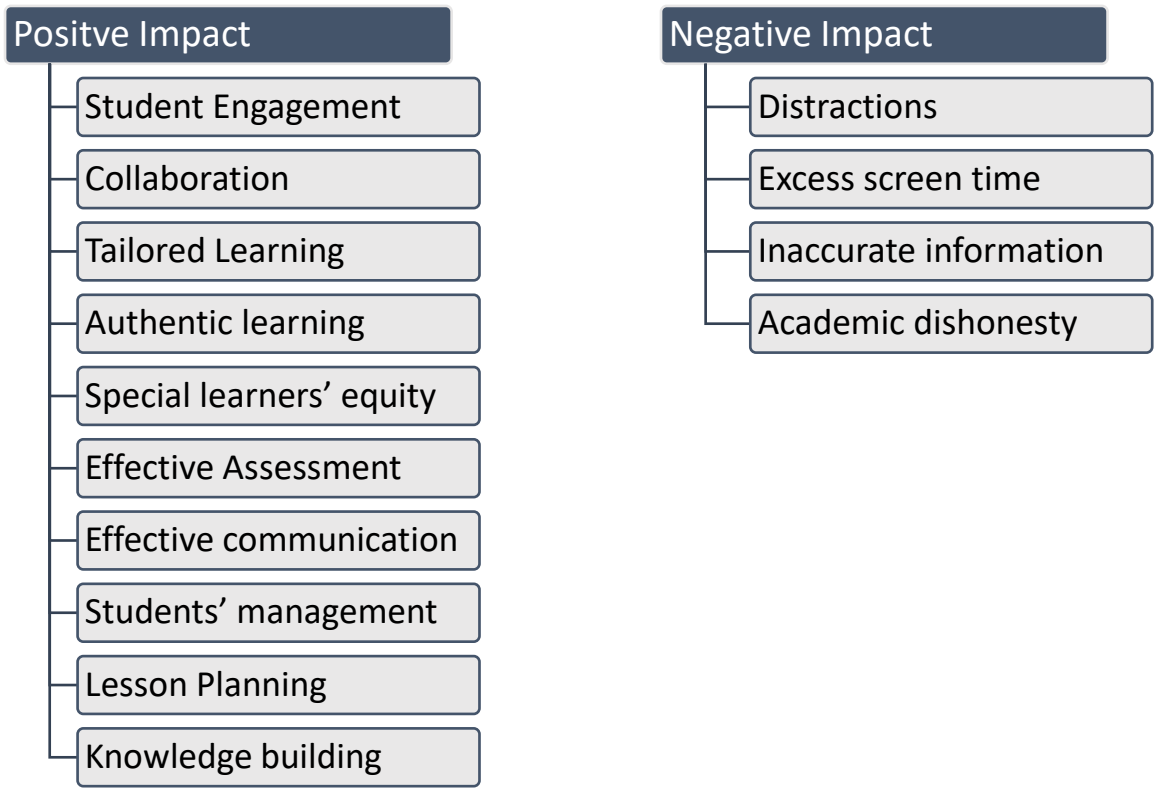

Figure 4.6 Impact of ICT According to Teachers

4.3.3 The Principals' Perspective on the Role and Impact of ICT

This section reports on the data collected from the interviews with the principals and provides a leadership viewpoint on the integration and effectiveness of ICT in enhancing the Learning Environments in NZ SDA schools. There was a distinct theme with five underlying sub-themes that emerged from the data.

4.3.3.1 Theme: ICT Is Viewed as Both Beneficial and Problematic to Learning

Principals had varied perceptions regarding the impact of ICT integration on the Learning Environment. Some saw it as impactful, while others saw it as a useful tool that could be used in learning. For example, Admin 3 emphasised ICT's role: "I think it plays a prominent role at the moment … I saw ICT playing a massive role," suggesting that the use of ICT significantly influences the Learning Environment. Conversely, some participants, like

Admin 4, argued that technology's impact depended on how it was used, "It's really how you are taught to use that tool, isn't it?" Overall, the principals viewed the use of ICT in Learning Environments as having both positive and negative aspects, and its use in the classroom could be either a blessing or a curse.

4.3.3.1.1 Sub-theme 1: The Use of ICT Allowed for Personalised Learning

The positive impact of ICT use identified by the principals included the way that digital technology integration allowed for more personalised learning. For example, Admin 1 said, "I think it has allowed for more individualised learning to actually work through assessments." Principals also highlighted that ICT enables real-time feedback which they found helped students. Admin 2 said, "The feedback we got was that instant feedback from the online tests was greatly beneficial."

In addition to personalised assessments, ICT was reported to support self-paced learning. For example, Admin 3 said, "It allows for students to work at their own speed. This doesn't hold back students who might otherwise get bored and disruptive." According to the principals, this overall improved the learning outcomes.

4.3.3.1.2 Sub-theme 2: The Use of ICT Facilitates Collaboration

The principals said that technology enables collaboration among teachers, improving their collegial relationships. For example, Admin 2 said, *"*Now, I find myself in this space where it's very easy for me to connect with my colleagues and, we can actually co-construct things quite easily. Not that easily, relatively easily. And that, of course, opens up a whole new dimension in collegial relationships."

The principals also highlighted that ICT enabled real-time communication and efficient resource sharing among staff and students. It also improved teamwork and professional development. For example, Admin 4 shared, "With shared drives, our teachers can quickly share, and we don't have to go around looking for things. It saves a lot of time. And it's the same for students. They have access to everything in Google Classroom."

4.3.3.1.3 Sub-theme 3: The Use of ICT Helped with ICT Literacy

The principals agreed that integrating ICT into the Learning Environment helped students to become technology-literate, affording them opportunities to build a better future after they leave school. For example, Admin 2 said, "What we hope to see are kids using ICT competently when they leave, when they go out into the workplace that they're not sort of left behind with, you know, how to use the technology, how to adapt, how to use it sensibly and effectively. That really is the outcome that we want ... and the board is really committed." This highlights the principals' shared objective of ensuring that students graduate with requisite ICT literacy.

4.3.3.1.4 Sub-theme 4: The Use of ICT-Facilitated Learning Beyond the Classroom

Principals reflected that ICT use enabled innovative learning models like hybrid learning to be established. This allowed continuity of the learning process even if circumstances did not allow for a traditional pedagogy. For example, Admin 3 said, *"*It did play a big role, but it played an even bigger role and the possibilities of it playing a bigger role were quite large ... we went into a hybrid model where we had the onsite teachers that could teach and the ones that couldn't, they could just beam from their classroom ... ICT played a major role in lessening the disruption to learning in that context." Reflecting on the impact of the COVID pandemic when schools moved to hybrid learning systems, the use of ICT helped create a connection between the school and home, enabling teachers to be aware of the conditions students faced at home. "And a lot of those kids were safe, secure, well-resourced. They hadn't been traumatised by something in their past. And they coped really well. Unfortunately, or fortunately, Covid exposed the reality of the kitchen table … And I had a number of teachers say to me, I actually zoomed in and saw [Student X] and it wasn't good ... So, what Covid did in that regard, it exposed a lot of things." Admin 4.

4.3.3.1.5 Sub-theme 5: The Use of ICT Caused Distraction and Restricted Interaction

The principals also commented on some negative impacts associated with the increasing use of ICT within schools. For example, Admin 1 highlighted that digital technology can be very distracting for students: "I think technology, if it's not used properly, is the greatest distractor

of kids ... and I think what we did well was we tried really hard not to pretend that school was normal. This was an emergency response." Another concern of principals was that the increasing use of ICT sometimes limited meaningful human interactions. Admin 2 shared, "I have noticed that the increasing use of devices isolates some students, which in my experience has negative effects on behaviour within classrooms." This highlights the importance of balancing ICT use with opportunities for face-to-face communication and collaboration.

4.3.3.2 Summary of Principals' Perspectives

From the principals' viewpoints, technology indeed had an impact on the Learning Environment for NZ SDA schools. Figure 4.7 below visually highlights the principals' views on the impact of the use of ICT in the Learning Environment.

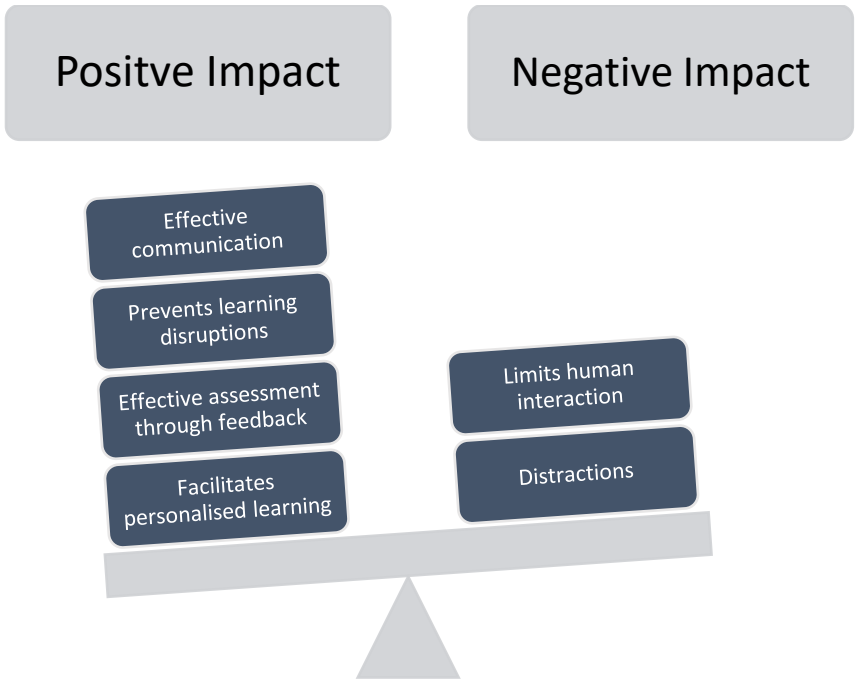

Figure 4.7 Impact of ICT According to the School Principals

Overall, the positive impact of ICT integration was more than the negative ones. The increasing integration of digital technology facilitated collaboration, enabled effective communication, allowed for feedback systems, supported hybrid learning models and individualised learning, and provided a linkage between school and home, heightening awareness of students' home conditions.

While the opinions of the principals varied, ICT was often viewed as a potent tool when effectively utilised. The positive impacts encompassed personalised learning, improved collaboration and communication, efficient feedback systems, support for innovative learning models like hybrid learning, increasing students' ICT competency, and establishment of links between school and home. However, challenges, such as digital distractions and limited in-person interactions, highlight the need for a balanced approach.

4.3.4 ICT and the Learning Environment Summary

Based on data from the students, teachers, and principals concerning the role and impact of ICT in school Learning Environments, ICT use was shown to increase the level of students' engagement, learners' collaboration, personalised/individualised learning, knowledge-building, special learners' equity and effective assessment. ICT integration in the Learning Environment made learning easier, increased student productivity, and made learning more accessible to the students. Effective communication was also increased as a result of the ICT integration within the Learning Environment. Using digital technology, the teachers found it easier to manage the students as well as plan for their lessons. Lastly, ICT integration within the Learning Environment helped with learning continuation even in the face of disruptive events like the COVID-19 pandemic or the physical absence of the teacher, as they could easily resort to a remote Learning Environment.

However, there were some negative findings of ICT integration within the Learning Environment. These were excess screen time for the students, distractions, dangers associated with inaccurate or false information from the internet, academic integrity issues, and limited human interaction. Table 4.6 is a comparative summary of the impact of ICT in the Learning Environments of the NZ SDA schools.

Table 4-6 The Impact and Role of ICT in the NZ SDA Schools' Learning Environment

	Students	**Teachers**	**Principals**
Positive Impact			
Students' Engagement	Enhances	Enhances	-
Collaboration	Enhances	Enhances	Enhances
Tailored learning	Enhances	Enhances	Enhances

Effective communication	-	Enhances	Enhances
Effective assessment	-	Enhances	Enhances
21st-century skills	Enhances	-	-
Special learners' Equity	-	Enhances	-
Knowledge-building	-	Enhances	-
Easy, productive, and accessible learning	Enhances	Enhances	-
Managing students and lesson planning	-	Enhances	-
Learning continuation (e.g. during Covid)	Enhances	-	Enhances
Negative Impact			
Excess screen time	-	Deterrent	-
Distraction	Deterrent	Deterrent	Deterrent
Inaccurate information	Deterrent	Deterrent	-
Academic dishonesty	-	Deterrent	-
Limits human interaction	-	-	Deterrent

4.4 What needs to be established at the system, school, and classroom levels to enhance the Learning Environment in NZ SDA schools; with a particular emphasis on the role of ICT?

This question seeks to find strategies necessary for optimising Learning Environments within NZ SDA schools with a particular emphasis on the role of ICT. It contends that improvements in the Learning Environment may require a holistic strategy, encompassing changes at the system, school, and classroom levels. This perspective recognises that improvements are likely to be effective if they can be made at each of these levels, as they are interdependent and collectively contribute to the overall quality of education. The goal is to develop a coordinated strategy that addresses the issues and opportunities within NZ SDA schools so that students have access to a quality Learning Environment that meets their needs.

This section will expand on the themes that emerged from the interview data collected from the three stakeholder groups. It contains the perspectives and recommendations of students, whose first-hand experience and insights help understand the current state of the Learning Environment. Following this, section 4.4.2 contains the viewpoints of teachers, who play a significant role in shaping the Learning Environment and are instrumental in implementing changes at the classroom-level. Their experiences and suggestions provide a practical understanding of what is feasible and effective in the context of everyday pedagogical practice. Section 4.4.3 contains the recommendations of principals, whose strategic vision and leadership are necessary for driving positive changes and making sure that improvements are sustainable, compatible, and support the goals of NZ SDA schools around holistic education. Their perspectives provide a higher-level view of the organisational and structural adjustments needed to facilitate the creation of more effective and engaging Learning Environments.

4.4.1.1 Students' Recommendations for an Improved Learning Environment

Students provided specific recommendations to improve the Learning Environment in NZ SDA schools. Their suggestions are categorised into two distinct levels: system-level and classroom-level.

4.4.1.2 System-level Recommendations

This section provides system-level recommendations that students suggest will improve their Learning Environment.

4.4.1.2.1 Refinement of Curriculum

Students expressed the importance of having a refined and well-organised curriculum. They pointed out that the current curriculum is too dense, leading to cognitive overload and lower engagement. A significant aspect of their feedback was the request for a curriculum that is extensive yet manageable. In other words, students want a curriculum where the learning material is such that they can absorb and understand information effectively without feeling overwhelmed.

For example, Student 1 emphasised the need for curricular improvement, "So I think the curriculum needs to step it up a little bit, to be honest." This statement suggests a desire for a more streamlined and focused curriculum, one that balances depth with breadth in covering the required topics. Student 7 asked for a system that allows for a thorough exploration of subjects but is paced in a way that students can engage with and comprehend the material. Student 7 said, "Sometimes I just don't get it. Like, it's important that we really get it. Overloading us with too many instructions quickly just doesn't help." It would seem that students want a flexible curriculum.

Furthermore, the students suggested the inclusion of a more interactive and larger variety of learning materials to complement the existing curriculum. They believed that a variety of learning resources, such as multimedia content, interactive exercises, and real-world case studies, would help their learning experience. This proposed diversity in instructional materials could cater to different learning styles, making lessons more inclusive and therefore effective.

Students from all three schools pointed out the importance of integrating current and relevant topics into the curriculum. They expressed a desire for content that includes contemporary

issues and developments that are of interest to students. This relevance in the curriculum is seen as important for keeping students engaged and preparing them for real-world challenges.

Every single interviewed student also called for more opportunities for project-based learning and hands-on experiences within the curriculum. They believed that applying theoretical knowledge to practical situations would increase their understanding and retention of information. Such experiential learning opportunities were viewed as essential for developing critical thinking skills and encouraging a stronger connection with the subject matter.

To summarise, the students want a curriculum that is relevant to them. The students' suggestions reflect a desire for a curriculum that facilitates the acquisition of useful knowledge, actively engages students, caters to their different learning needs, and prepares them for the future.

4.4.1.3 Classroom-level Recommendations

The interviewed students identified four major areas where the utilisation of ICT in the classroom could improve their learning outcomes.

4.4.1.3.1 Interactive Teacher-Student Relationship

Students placed significant emphasis on the necessity for teachers to effectively engage with them. This need for improved teacher-student engagement was highlighted as a significant factor in a quality Learning Environment. For example, Student 5 emphasised the need for teachers to engage more with their students by stating, "I think they need to be more like interactive with the students. Like talk to them and like go through with them," underlining the importance of ongoing dialogue between teachers and students for effective comprehension. This recommendation points to a desire for a more engaging and supportive Learning Environment, where teachers actively facilitate understanding through direct communication and interaction.

Most students said that teachers could adopt a variety of interactive techniques to create a more engaging classroom atmosphere. These methods included open discussions, question-and-answer sessions, and interactive group activities, which encouraged students to participate actively in their learning process. In addition, students expressed the need for personalised feedback and guidance from teachers. They suggested that teachers should invest time in understanding each student's learning style and provide personalised learning opportunities.

To summarise, the students are seeking a more personalised and interactive learning experience. They asked for strategies that involve active dialogue, the use of different interactive methods, the integration of technology, and personalised support. These recommendations reflect a collective desire for a Learning Environment that is informative, engaging, supportive, and conducive to a deeper understanding of academic content.

4.4.1.3.2 Incorporation of Engaging Activities

Students conveyed a strong preference for the integration of engaging and interactive activities within their classes. They said that this significantly increases student involvement and stimulates discussion, thereby improving the overall learning experience. These recommendations reflect a desire for a more participatory classroom environment, moving away from traditional, lecture-based instruction.

In particular, Students 2, 6, and 7 specifically mentioned the value of incorporating interactive activities, believing that these would encourage greater student involvement and enable more meaningful discussions. This perspective illustrates the importance to students of active learning strategies, where students are active participants in the learning process.

In addition to interactive activities, there was a request from the students for more hands-on, practical learning experiences. They expressed a belief that learning by doing through practical, tangible activities significantly improves both understanding and engagement. For example, Student 8 stated, "I'd say more hands-on practical stuff." This recommendation highlights the value students place on experiential learning, where they can apply theoretical knowledge in real-life contexts.

Expanding on these ideas, students suggested that incorporating project-based learning, simulations, and lab experiments could provide the hands-on experiences they seek. Such activities bring theoretical concepts to life and help develop critical thinking, problem-solving, and collaborative skills. Moreover, students recommended the use of ICT to create virtual simulations and interactive models, which could enable practical learning, especially in particular subject areas where learning resources are limited.

Students expressed a desire for these interactive and practical learning experiences to correspond directly with real-world applications. They believed that understanding the relevance of what they are learning to real-world scenarios would deepen their engagement and prepare them for future employment. Overall, the findings indicate that students want a shift in teaching methodologies, favouring strategies that include interactive, hands-on, and practical learning experiences. These experiences, as envisioned by the students, would make learning more engaging, enjoyable, relevant, and effective.

4.4.1.3.3 Avoid Information Overload

Students expressed a need for educators to be mindful of the volume of information delivered in class. They highlighted the importance of pacing to ensure effective comprehension, especially given the broad range of subjects they study. For example, Student 6 conveyed, “I would say to take each period at a time and to not give too much information, like information overload to students ... we have so many other subjects too. And those subjects are more things to learn too.”

Furthermore, the students valued classes where teachers simplified complex topics by breaking them down into smaller, more understandable parts. This was particularly appreciated as it accommodates different learning paces and styles, making the material more accessible to everyone. As Student 4 stated, “When teachers break down a big topic into smaller parts, it makes it so much easier to get it ...” In addition, students proposed the incorporation of visual aids and real-world examples to improve understanding and retention of information. By contextualising information within practical applications, teachers can make learning more relatable and less overwhelming for students.

Collectively, the findings demonstrate that students want a Learning Environment in which they are not overwhelmed. They find teaching strategies that prioritise focused and interactive learning experiences to be effective. According to the students, this prevents information overload and results in a more conducive environment for learning, where students can engage with and effectively absorb content.

4.4.1.3.4 Effective Integration of Technology

A strong emphasis was placed by students on the need for more effective and innovative use of ICT within their learning process. They proposed two main methods for incorporating digital technology in education. The first was dedicating specific days to technology-focused activities and the second was using ICT actively. These suggestions reflect their belief in the potential of ICT to transform learning experiences into something more interactive and engaging. For example, Student 1 commented, "Maybe add technology a bit more ... like make some days you do technology, like presentations I guess." This recommendation indicates a desire for a structured yet flexible methodology for technology integration. Students said that they wanted to be in control of the decision to use or not to use ICT within lessons.

All the surveyed students communicated dissatisfaction with the passive use of technology. Students specifically mentioned that merely being assigned to watch videos on streaming websites like YouTube was boring. They expressed a preference for more interactive and participatory uses of technology. This reveals a desire amongst students for ICT use that goes beyond using it just for information delivery or taking down notes. They favour applications that actively involve them in the learning process.

Expanding on these ideas, students suggested the integration of digital games into the learning process, such as Mathletics and Kahoot. They believed that these educational games could significantly improve the enjoyment and engagement factor in learning. For instance, Mathletics, with its interactive math challenges, could transform a traditionally challenging subject into an enjoyable experience. Similarly, they mentioned that Kahoot, known for its

game-based learning, could be used to conduct fun quizzes and interactive competitions, leading to a lively and competitive lesson.

In addition, students pointed out that digital technology could play an enabling role in facilitating collaborative learning experiences. They envisioned technology being used to organise group projects, where students could work together on shared documents and presentations, encouraging teamwork and communication skills. For example, a group project could involve students collaborating on a science presentation using software, such as shared Google Slides, enabling them to combine their research and creativity effectively.

Students also highlighted how ICT enables them to conduct virtual field trips and simulate real-world scenarios. They mentioned that by using Google Earth, they could do virtual tours of historical sites and important places, providing students with immersive learning experiences that might otherwise be inaccessible. The students' recommendations reveal innovative ways in which technology can be utilised to make learning more enjoyable, relevant, and practical. By incorporating digital games, facilitating collaborative projects, and employing virtual simulations, educators can create an engaging and interactive Learning Environment that students value.

The data from the student interviews reveals that students are seeking a more active and diversified use of technology in their education. They envision a Learning Environment where digital technology is a central component that increases the interactivity, personalisation, and relevance of the learning material. Having such an integration of ICT within the Learning Environment is envisioned as creating a more engaging and effective student-centred learning experience.

4.4.2 Recommendations from Teachers' Interviews

This section examines the recommendations gathered from teacher interviews. These recommendations encompass strategies at both the school and classroom levels that the teachers view as important in improving the learning experience and outcomes.

4.4.2.1 School-level Recommendations

In this section, we examine the findings related to school-level recommendations provided by teachers aimed at improving the integration and effectiveness of ICT within their Learning Environments.

4.4.2.1.1 Develop a Hybrid Learning System

Many of the teachers interviewed spoke about the benefits of a hybrid learning system. For example, Teacher 15, commented, "We opened up Google Meet in the classroom, allowing pupils in different locations to connect to it, which worked brilliantly." This statement highlighted the utilisation of ICT to facilitate connections between pupils within the classroom and those participating remotely.

Teachers suggested that a hybrid learning system was conducive to catering to different learning styles and student needs. By merging in-person and online pedagogy, teachers mentioned that they were able to provide more personalised instructions. They gave examples of pupils who thrived in a traditional classroom environment and benefited from direct interaction with teachers and peers, while those who preferred or required distance learning were provided a similar education experience online.

Teachers spoke about a hybrid model providing opportunities for incorporating a wide array of digital resources and learning materials. For example, Teacher 15 remarked, "It was a game-changer, allowing us to provide material and keep in touch with students who couldn't be physically present." This statement highlights the flexibility and adaptability of the hybrid model.

Collectively, the teachers interviewed for this study were very supportive of the implementation of hybrid learning systems. This was viewed as a progressive step towards meeting student needs. The teachers pointed out that such a system can meet the varied needs of students while also capitalising on the strengths of the educators themselves. This model is regarded by the teachers as a significant advancement in supporting a Learning Environment that is inclusive and adaptable.

4.4.2.1.2 Increase Investment Towards Digital Technology

The teachers interviewed emphasised the necessity of increasing investment in ICT. This investment was spoken of as requirements to facilitate the effective integration of ICT within the Learning Environment. For example, Teacher 18 pointed out, "It won't work if we don't have all schools equipped with the necessary devices and technology." This statement highlighted the importance of providing adequate resources and devices available for a smooth and uninterrupted learning experience.

All the teachers interviewed indicated that schools needed to prioritise the allocation of sufficient funds for specific components of ICT. This investment was about procuring devices and creating modern, innovative learning spaces. It involved equipping classrooms with effective digital devices and reliable internet connectivity and providing students and teachers with access to online learning apps. Teacher 18 added, "The disparity in resources between schools can create a divide. It's really important that all schools are on a level playing field with technology." This highlights the issue of equity in schools.

The findings also suggest that investment in technology should be accompanied by Professional Development for teachers. For example, Teacher 12 remarked, "Having the technology is one thing, but they should make sure our teachers are trained and comfortable using it is just as important." This perspective reveals the need for ongoing training and support for educators to effectively integrate technology into their teaching practices.

This section highlighted the need for increased investment in ICT. This investment is important in equipping schools with the necessary hardware and software needed in a quality learning environment that incorporates ICT. The focus on equitable access and professional development for teachers further illustrated that a holistic strategy is needed to increase chances for success.

4.4.2.1.3 Supervision of Students' Online Interactions

Many of the teachers emphasised the importance of vigilant supervision of students' interactions online, especially given the dangers associated with online activities. For

example, Teacher 19 stated, “Strict guidelines and constant supervision were necessary to ensure students’ safety and appropriate use of technology.” This comment reveals the need for clearly defined rules to safeguard students from online risks such as cyberbullying, exposure to inappropriate content, and digital distractions.

Other teachers reiterated similar ideas. Teacher 12 remarked, “It was to the top of the list to educate our students on the risks and rewards.” And Teacher 7 added, “We did things differently, combining supervision with education on digital citizenship.” Furthermore, Teacher 19 elaborated on the need for proactive education in digital citizenship and online safety, “We needed to guide our students to be responsible, respectful, and safe on the internet.” This highlights the importance of establishing clear boundaries and educating students about ethical and safe ICT use.

The findings also indicate that supervision needed to be complemented by positive reinforcement. For example, Teacher 10 shared, ‘We found that combining supervision with positive reinforcement, like rewarding responsible online behaviour, significantly improved students’ online behaviour. I think the work we did on cyber safety really paid off.”

Teachers suggest that the responsibility for monitoring ICT use extends beyond the classroom. It requires coordinated and collaborative efforts between the school, teachers and parents. Teachers mentioned that this partnership was essential in establishing clear boundaries for ICT use and having safeguards in place so that students are safe online.

This section presented data that shows that the supervision of students’ when they are online is considered very important by the surveyed teachers. This supervision is not about imposing limitations. Its purpose is to create a safe, informed, and responsible digital environment for students. As Teacher 4 noted, “It was about striking a balance, setting guidelines while also encouraging students to make smart choices online.” This involves creating clear guidelines, facilitating collaboration between educators and parents, and educating students about digital citizenship and online safety.

4.4.2.1.4 Collaboration with Parents and Caregivers

Teachers highlighted the importance of collaboration between schools and parents or caregivers in creating an effective Learning Environment. Teacher 8 spoke about active parental involvement in the learning process, saying "It's just so very important to collaborate with parents to come together and understand that the system has to be cohesive." This insight points to the value of an effective working relationship between teachers and caregivers in influencing a student's learning outcomes.

The findings suggest that regular and open communication between schools and parents is important. Teacher 5 noted, "We have seen very good results when we maintain good lines of communication with parents. It's about creating a partnership. I like how easy and faster it is communicating digitally…" This involves keeping parents informed and engaged with their child's progress and the school's activities.

Involvement in decision-making processes was another aspect emphasised by the teachers. For example, Teacher 9 shared, "When we involve parents in decision-making, especially regarding the use of technology in classrooms, we like to make sure that we take their ideas on board. We've found this really helpful." This illustrates that by actively engaging parents, one gains 'buy-in', which can lead to more effective classroom outcomes.

Overall, it is evident from the findings that the collaboration between schools and parents or caregivers was an important component of the Learning Environment. By encouraging regular communication and involving parents in meetings and decision-making processes, teachers were able to educate them about classroom technologies and learning strategies. This enabled schools to work collectively to improve the Learning Environment.

4.4.2.1.5 Ensure a Technology-Literate Staff

The teachers interviewed in this study expressed the importance of digital technology literacy. For example, Teacher 8 emphasised equipping educators with essential ICT skills, noting, "Supporting educators in acquiring the necessary tech skills through professional development and training is essential." This perspective was also corroborated by different teachers, reinforcing the idea that continual skills development is essential for teachers to stay abreast of rapidly advancing classroom technology. These insights collectively recognise the need for ongoing professional growth in ICT to transform pedagogy.

The findings suggest that schools should organise regular training sessions, workshops, and seminars to increase teachers' ICT competencies. For example, Teacher 12 elaborated: "We've initiated regular PD where professionals come in to teach us the latest technology. It's been incredibly beneficial." This strategy enables educators who are not competent with ICT to start increasing their ICT capacity. Teacher 7 shared their experience, "The training sessions have been a game-changer. They've improved my tech skills and boosted my confidence in using it …" This reflects how professional development in technology can positively impact teachers' efficacy and confidence.

Teacher 10 highlighted the importance of continuous learning, "In this crazy fast-paced day and age, we need to be lifelong learners. The PD was really good." This observation highlights the importance for educators to engage with professional development. It suggests that continuous professional development is required to keep pace with ICT advancements and to increase teaching effectiveness. The findings also suggest that NZ SDA schools should consider customised training programmes that is designed to cater to their staff's specific needs and skill levels. For example, teacher 3 suggested, "I find it hard to keep up, where we can learn at our own pace and focus on the stuff, we are most likely to use…"

The findings of this section suggest that developing ICT-literate teaching staff members is important in a quality learning environment. By providing teachers with the necessary training and professional development opportunities, schools can equip their educators to optimally use ICT, thereby, according to the teachers, improving the quality and effectiveness of pedagogy.

4.4.2.2 Classroom-Level Recommendations

This section examines the classroom-level recommendations teachers provided, focusing on effectively using ICT within their Learning Environments.

4.4.2.2.1 Implement Constructivist Pedagogy

Constructivist pedagogies were identified as an important factor in improving the Learning Environment at the classroom-level by multiple teachers. Multiple teachers identified implementing constructivist pedagogies as an important factor in improving the Learning Environment at the classroom-level. According to the interviewees, this necessitates adjustments and the purposeful integration of ICT to support a learning process where students actively construct their understanding.

Teachers spoke about project-based learning and content creation as essential components of this strategy. They favour shifting the focus from passive consumption to active creation, utilising technology to allow students express their passions. For example, Teacher 1 elaborated, "And then someone challenged me one day and said, 'Well, we don't want them to consume, we want them to create.' And it's like, 'Oh, well, what does that look like?' It's how you can utilise programmes and apps and things like that to create something and have passion and drive for something that you're passionate about and use the technology to get there. So, creating something ... that's sort of in line with the more constructivist pedagogy where students are doing projects and creating stuff is a super cool thing to do."

Teachers suggested that ICT should be used as a means of delivering information and as a facilitator of inquiry, exploration, and creative expression. According to them, it involves integrating ICT in a way that allows students to engage in research, collaborate on projects, and produce original works, thereby actively engaging with the learning material. Furthermore, all the teacher interview data highlights the importance of providing students with opportunities to engage in hands-on activities and real-world problem-solving learning activities enabled by technology. This matches constructivist principles and encourages critical thinking, creativity, and a deeper understanding of the subject matter.

Blending classroom practices with constructivist pedagogy and using digital technology to encourage active learning and content creation, as opposed to just consumption, is important for student success. According to the teachers, this enables students to take ownership of their learning, turning the classroom into a space of exploration, creativity, and meaningful engagement with technology.

4.4.2.2.2 Balance Technology and Traditional Methods

Teachers emphasised the importance of striking a careful balance between the use of technology and traditional learning methods in the classroom. According to teachers, this is essential for catering to different learning styles and preferences and ensuring all students benefit from ICT.

Teachers highlighted the necessity of this balance, noting the importance of acknowledging individual differences in learning styles. "We need to think about individual learning styles and preferences…" Teacher 8 stated. This perspective highlights that while technology can enhance learning, it should not replace traditional methods. Instead, a strategy that combines the strengths of both modern and traditional pedagogy was advised. Teachers suggested that a hybrid methodology could be effective. They said it could involve combining interactive digital content with traditional teaching methods like lectures, discussions, and textbook-based learning. Such a blend allows for a more versatile Learning Environment that is adaptable to different student needs.

The teacher interview data suggests that providing a variety of instructional methods can help maintain student engagement and motivation. Many of the teachers specifically mentioned that alternating between technology-driven and traditional teaching methods, while maintaining positive relationships with the students, makes the learning experience interesting. It also enables catering to a wide range of learning preferences and needs.

4.4.2.2.3 Increasing Student Engagement

All the interviewed teachers emphasised the importance of increasing student engagement, considering it an essential part of effective pedagogy. They recognised student engagement to effective pedagogy. They also highlighted the necessity of maintaining an interactive and participative element in the Learning Environment.

For example, Teacher 11 particularly emphasised incorporating practical applications in teaching, recognising the varied forms that engagement can take depending on the learning context, and stated, "The need for practical applications is so important, recognising that engagement can be different, in different learning contexts." This statement points to the importance of relevant and hands-on learning experiences, which can significantly boost student involvement and interest in the subject matter.

The teachers suggested that engagement in the classroom can be improved through a range of strategies, including group discussions, project-based learning, and making the lessons more interactive. According to these teachers, such methods encourage students to actively participate in their learning, resulting in a deeper connection with the learning material, which, in turn, results in authentic learning experiences.

Teachers also said that cultivating a supportive and inclusive classroom atmosphere that motivates all students to actively participate and contribute is important. They observed that some students tend to share more in online environments than in physical classrooms. Both teachers highlighted that through the implementation of inclusive teaching practices, such as providing frequent positive feedback and establishing a safe space for students to freely express their ideas and opinions, they noticed a marked increase in student engagement. They found that this encourages more open communication among students and increases a sense of belonging and confidence. For example, Teacher 5 explained, "When students feel genuinely valued, they become more confident to contribute to class discussions …" reinforcing the idea that open communication and a strong sense of belonging can lead to higher levels of participation.

The findings reveal the need for increasing student engagement. This can be through practical lessons, interactive teaching methods, and the effective integration of ICT. By adopting holistic pedagogical strategies, teachers can create a more participatory, engaging, inclusive, and therefore effective Learning Environment that caters to the varied needs of students, thereby improving their learning experiences.

4.4.2.2.4 Teaching Students to Question and Verify Online Content

Half the teachers interviewed spoke about the need to address the reliability and validity of information that students were accessing. They were very supportive of the need to educate students on how to discern and validate credible sources amidst the overwhelming amount of false or misleading information available online. Teachers mentioned that this is an increasingly important skill because it helps students be safe online.

For example, Teacher 12 stated, "It's about finding information … it's about finding the right information. We have to teach our students not to accept everything at face value." In this context, this statement highlights the importance of critical thinking in evaluating online content. Teachers spoke about teaching students the skills required to assess website credibility and the validity of information. For example, Teacher 4 said, "Integrating lessons on evaluating information sources becomes so very important. We need to make it a part of our curriculum to teach students to question, analyse, and cross-check information."

Teachers also suggested equipping students with specific skills to differentiate between reliable and unreliable information. For example, according to Teacher 14, "We need to equip our students with the tools to differentiate between reliable and unreliable sources. This involves looking at the author's credentials, checking for biases, understanding the context, and comparing information from multiple sources." In short, the interview data reveals that teaching students the skills to check for the reliability of information is an essential component of digital literacy education. By incorporating focused lessons on evaluating information sources, teachers can provide students with the skills to correctly evaluate the authenticity of information.

4.4.2.3 Summary

The interview data from teachers serves as a strategic guide for enhancing the Learning Environment in NZ SDA schools. At the school-level, teachers have put forward five strategic recommendations. The first was to develop a hybrid learning system. Secondly, increase investment towards digital technology; thirdly, supervise students' online interactions; fourthly, collaborate with parents and caregivers; and lastly, ensure a technology-literate staff. At the classroom-level, there are four recommendations: firstly, implement constructivist pedagogy; secondly, balance technology and traditional methods; thirdly, increasing student engagement; and fourthly, teach students to question and verify online content.

4.4.3 Principals' Recommendations for Enhancing the Quality of the Learning Environment

This section examines the principals' recommendations for enhancing the Learning Environments in NZ SDA schools utilising ICT. Recognising the complex nature of educational improvement, the principals categorised their recommendations into three distinct levels: system, school, and classroom.

4.4.3.1 System-level Recommendation

This section unpacks the system-level recommendation suggested by principals for improving the integration of ICT in NZ SDA schools. These recommendations address the structural and policy aspects necessary to enable effective ICT implementation across the educational system.

4.4.3.1.1 Increased Funding from the Ministry of Education

Principals strongly expressed the need for increased funding from the Ministry of Education. This was identified as an important step in increasing the ICT capabilities of schools. The principals specifically highlighted how additional funding from the ministry would enable

schools to hire ICT support staff and improve their ICT infrastructure. Principals widely recognise the importance of financial resources in advancing ICT integration in schools.

For example, Admin 3 elaborated, “Our collaboration with experts has been just so very important, but the progress depends on increased funding from the ministry. We’re in a holding pattern, waiting for the funds to implement our ICT plans.” Such statements highlight the dependency on adequate funding.

Another principal, Admin 1, shared similar thoughts, “The potential of ICT is immense, but without the proper funding, we’re limited in what we can achieve …” This idea speaks to the current financial constraints schools face. Admin 2 added, “It’s a lot of money, we’re talking about buying devices, about building a sustainable ICT infrastructure. For that, we need substantial investment from the government.” This comment further emphasises the need for significant financial investment in purchasing devices that students use, funding the ICT infrastructure and support.

The main finding from this section is that principals regard increased funding from the Ministry of Education as a fundamental requirement for the effective integration of ICT in schools. This financial support is seen as essential for employing necessary staff and investing in infrastructure to meet the needs of students. The principals view this increased funding as a significant driver in bridging the gap between current capabilities and the potential for ICT to transform the Learning Environment.

4.4.3.2 School-level Recommendations

In this section, we unpack the school-level recommendations made by principals regarding the integration of ICT within their schools.

4.4.3.2.1 Increased Financial Investments in ICT Infrastructure

Principals placed significant emphasis on the need for increased financial investments in ICT infrastructure at the school level. For example, Admin 4 highlighted this aspect, acknowledging the very important role of financial resources in enhancing the Learning

Environment through technology. "From my experience, investing in quality online programmes has proven to be extremely beneficial," remarked Admin 4. In addition, Admin 4 elaborated, "It's about having the right technology that meets our needs and goals. We need things that just work." This comment points to the necessity of investing in technology and making sure that the investments meet the specific requirements and objectives of the educational institution.

Other principals reiterated similar viewpoints. Admin 2 stated, "Adequate funding for ICT is just so very essential. Without it, we can't properly provide students with what they need …" Such views highlight the connection between financial investment in technology and the ability to provide a Learning Environment that is modern and one that students value. Admin 3 also added, "Investment in ICT isn't an expense; it's an investment in our students' future. Ensuring they have access to the latest technology is essential for their development." This view conveys the idea that financial allocation towards ICT is a worthwhile investment in the future because it creates opportunities to equip students with 21st-century skills.

The principals emphasised the necessity for increased financial investments in ICT infrastructure. They specifically mentioned that funding is essential for acquiring ICT that is up-to-date and enables the educational objectives. This is considered a fundamental step toward creating a high-quality, ICT-enhanced Learning Environment that can be utilised effectively, without the frustrations associated with outdated or unreliable technology.

4.4.3.2.2 Establishment of Hybrid Learning Systems

During the interviews, the principals repeatedly expressed support for the establishment of hybrid learning systems. They supported this model because of its ability to maintain educational continuity, especially when in-person teaching is not possible. According to them, this aims to create a continuous learning experience between the school and home environments.

For example, Admin 2 elaborated on this concept, stating, "To have a device, to have that ability to still engage in my learning when I'm not here. We're discussing, you know, what some refer to as the hybrid system. I view it as continuous learning between home and

school when they cannot be physically where we want them to be. That's a major part of my drive for this initiative." This view highlights the principal's desire to utilise technology in a way that bridges the gap between traditional classrooms and remote learning. If implemented well, this can provide students with another means to access learning material.

Other principals shared this vision. For example, Admin 4 commented, "Integrating a hybrid learning system is about preparing for the future. It's about our students having uninterrupted access to education, regardless of circumstances." Admin 1 added, "A hybrid system isn't just a response to COVID, it's an evolution in how we teach. It provides flexibility and caters to different learning styles and needs." Overall, the establishment of hybrid learning systems, as recommended by the principals, is seen as a significant step in the evolution of Learning Environments. By ensuring the utilisation of in-person and remote learning, this model caters to immediate needs. It also allows for more flexibility in keeping pace with the needs of students.

4.4.3.2.3 Monitoring Students' Safety in Online Activities

The principals' recommendations highlighted the importance of monitoring students' safety in online activities. For example, Admin 4 spoke about this aspect in ensuring a secure and safe online Learning Environment and noted, "Ensuring students' safety is a major responsibility for us. When dealing with children engaging inappropriately or searching for unsuitable content, it becomes imperative for teachers to manage and monitor these activities. You can track history, but it's about being proactive in ensuring they're using the internet safely and appropriately. Operating in the online space, especially within the school environment, adds a layer of complication."

This observation was reiterated by other principals. Admin 1 commented, "It's more than just about providing access to technology. It's about protecting our students in that digital space. We've implemented strict guidelines and regular monitoring to ensure their safety online." Comments such as these highlight the need for enforced rules and vigilant supervision to protect students online.

Admin 3 added, “We’ve integrated digital citizenship lessons into our curriculum. It’s important for students to understand the responsibilities that come with internet usage.” This highlights the importance of educating students about safe and responsible online behaviour.

Furthermore, Admin 1 remarked, “We’ve invested in secure internet filters and regularly update our safety systems. It’s an ongoing process to keep our students safe online.” Such statements indicate the need for technical solutions and continuous updates to online safety measures and that monitoring students’ safety in online activities is required to effectively integrate ICT into Learning Environments. Principals pushed for a combination of vigilant supervision and enforced safety rules. They also spoke about the explicit teaching of cyber safety, digital citizenship, and the implementation of technical safety measures such as web filtering.

4.4.3.3 Classroom-level Recommendations

Principals shared some classroom-level recommendations for integrating ICT effectively into the Learning Environment. These recommendations reflect the principals’ strategic vision for positively transforming classroom experiences through the effective use of technology. Focusing specifically on classrooms, the principals identified specific areas where ICT can improve pedagogy, presented below.

4.4.3.3.1 Increasing Learners’ Engagement

The principals interviewed placed a significant emphasis on increasing learners’ engagement. For example, Admin 2 highlighted this as a fundamental aspect of improving educational outcomes and stated, “The main focus, in my view, should be on improving students’ engagement with their learning.” Such statements highlight the belief that increased student engagement is an important driver for successful learning experiences.

In addition, Admin 2 elaborated, “Engagement isn’t just about keeping students busy. It’s about inspiring them, sparking their curiosity, and utilising technology to make lessons more interactive and relatable.” This viewpoint suggests that engagement encompasses more than participation; it actively stimulates students’ interest and enthusiasm for learning.

Other principals shared similar views. Admin 3 commented, "We've seen that when technology is used creatively, it can significantly boost students' involvement and interest in the subject matter." Such observations point to the ability of ICT to transform traditional learning experiences into more participatory and engaging learning activities. Furthermore, Admin 4 pointed out the role of technology in personalising learning experiences. "With technology, we can tailor learning to individual student needs, which has been instrumental in keeping them engaged and motivated." This customisation was described as important in maintaining students' focus and interest, as it caters to their different learning styles and preferences.

The principals' recommendations, overall, emphasise boosting learner engagement as an important objective. Educators can improve learning outcomes by enhancing student engagement through interactive, personalised, and inspiring applications of technology. This strategy demonstrates a sound understanding of how technology can create a more effective Learning Environment, leading to greater student success.

4.4.3.3.2 A Balance of ICT Use and Traditional Pedagogical Methods

The principals significantly focused on maintaining a balanced strategy between ICT-supported learning and traditional teaching methods. For example, Admin 1 spoke about an equilibrium, highlighting the need for prudent management of screen time, and remarked, "So, I think a lot of teachers learned that being on the screen all the time was not good. It's about finding that sweet spot where technology complements, rather than dominates, the learning process."

This was supported by other principals as well. Admin 4 pointed out, "While technology is a fantastic tool, we mustn't lose sight of the value of face-to-face interactions and traditional learning methods. It's about striking the right balance." Such views highlight the importance of integrating technology to enhance, rather than replace, traditional pedagogy.

In addition, Admin 3 mentioned, "We've found that a mix of digital and traditional teaching caters to different learning styles and most of the time keeps students engaged." This

statement suggests that combining digital and traditional teaching pedagogies can effectively cater to different student needs, keeping students more interested and involved in their learning.

Admin 5 added, “Incorporating technology into our teaching strategies is essential, but we must also ensure that it’s used judiciously. The goal is to enhance learning, not to overwhelm the students with constant digital stimulation.” Comments such as these reflect the understanding that while ICT is becoming embedded, its use needs to be carefully managed to minimise the negatives.

The principals, collectively, want a balanced strategy for integrating ICT within Learning Environments. This balance involves judiciously blending technology with traditional teaching methods to create a holistic learning experience. By finding the optimal mix of digital and face-to-face learning, educators can provide a more personalised and inclusive learning experience. This, in turn, makes the learning environment effective because it can cater to different learning preferences.

4.4.3.3.3 Supporting the Creative Use of ICT

The surveyed principals provided a somewhat different view on increasing the creative use of ICT in Learning Environments. Analysis of the data collected from these principals revealed a consensus that some teachers within their schools could improve their creative application of ICT. For example, Admin 2 highlighted the necessity for learners to be given the freedom to use ICT in imaginative ways. This is important for developing a learning atmosphere that is both productive and engaging. Such an environment encourages creativity among students. This, in turn, encourages a more interactive and engaging Learning Environment.

Admin 2 elaborated on this concept, stating, “My biggest challenge is that at present, teachers control much of the technology use. We consulted with experts, who immediately questioned the level of creative freedom we allow our students. They asked, ‘How much do the children have the freedom to start creating and making and doing that?’ And I realised they don’t, not even in basic tasks like recording, editing, and posting. This year, we’re focusing on

involving the students more in these activities. We're probably holding them back by not letting them engage more hands-on with the technology."

The principals spoke positively about a shift towards giving students more autonomy in their use of technology, encouraging them to create as opposed to consume. For example, Admin 4 noted, "We've seen a surge in student engagement when they're allowed to use technology in a way that lets them be creators." Such observations point to the importance of moving beyond the passive use of technology to a more active, creative involvement. Admin 3 also added, "Encouraging students to experiment with technology in their projects has sparked some incredibly innovative stuff. It's about trying to get them to think outside the box." These statements illustrate how ICT can improve creativity and spark innovation.

The findings from this section suggest that an important aspect of effectively integrating ICT into the learning environment is allowing students the freedom to engage with it creatively. By shifting from a teacher-centred method to a more student-driven model, teachers can maximise the benefits of ICT. This shift, when managed well, can help develop self-directed learning.

4.4.3.4 Summary of Principals' Recommendations

At the classroom-level, the principals emphasised the importance of increasing learner engagement through innovative and interactive uses of ICT. This involves integrating ICT in a way that makes learning more engaging and personalised, catering to students' individual needs. The principals from all three schools expressed a desire for a balanced teaching methodology. This strategy combines the strengths of both technology and traditional teaching methods, aiming to create a more personalised and engaging learning experience.

Furthermore, supporting the creative use of technology was highlighted as an important aspect. Principals encouraged educators to think innovatively about how technology can improve learning, pushing beyond conventional boundaries. At the school-level, three strategic recommendations were proposed by the principals. They emphasised the importance of increasing financial investments in ICT infrastructure, which they said was essential for supporting a modern, well-equipped Learning Environment. This investment includes upgrading digital resources and ensuring all students have reliable access to

technology. The second was the establishment of hybrid learning systems was recommended. These systems blend in-person and online education, providing flexible and varied learning experiences. The final was a focus on ensuring the safety of online activities by monitoring the Learning Environment for distracting and harmful content.

At the system-level, the need for increased funding from the Ministry of Education was identified as a significant factor. Principals pointed out that adequate support and investment are essential for the successful implementation and long-term sustainability of ICT initiatives. Figure 4.8 visually summarises these recommendations aimed at improving the quality of the Learning Environment. It highlights the importance of monitored/balanced screen time, promoting creativity in digital technology use, strategic financial investments, engaging learning experiences, and ensuring a safe online environment.

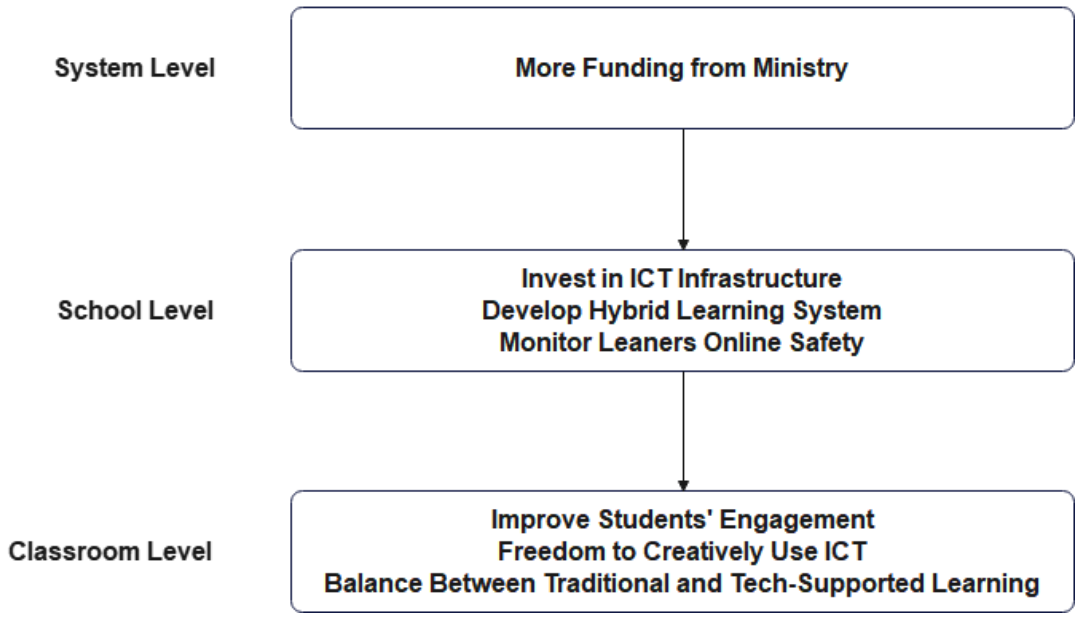

Figure 4.8 Recommendations to Improve the Quality of the Learning Environment by the School Principals

Overall, these recommendations endorse the effective integration of ICT within the Learning Environment. However, as indicated in their recommendations at the classroom-level, there are unresolved tensions in the principals' communications. The principals state that they support both the use of ICT-focused and traditional-focused strategies within the Learning Environment. Therefore, by addressing enhancement suggestions at the classroom, school,

and system-levels, the goal is to create a Learning Environment that is innovative, engaging and well-equipped to maximise student success.

4.5 Summary of Results and Analysis of the Study

This chapter presented the results and analysis of the data gathered. By analysing the viewpoints of students, teachers, and principals, this study provides an understanding of the influence of ICT within the Learning Environments from the viewpoints of these stakeholders.

Students' perspectives highlighted their learning motivations, preferences, and challenges in a period of rapid change. Their experiences and feedback emphasise the central role of ICT within the Learning Environments. Students spoke about the benefits of ICT in improving their learning experiences, pointing to increased engagement and access to online resources that enable learning. However, they also spoke of the need for 'a balance' saying that there was a need for moderation in screen time to avoid digital fatigue and ensure sustained attention. This duality illustrates the necessity of implementing strategies prioritising student well-being and academic achievement.

Teachers provided a distinct perspective. They spoke about the importance of adaptability and sound pedagogically driven implementation of ICT. Their insights highlight their important role in integrating ICT with traditional teaching methods. Teachers also emphasised the necessity of ongoing professional development to effectively utilise ICT so that it helps rather than detracts from learning. They said that when ICT is used effectively, it can create learning experiences that support a wide range of learning styles and needs of a digitally native student population.

On the other hand, principals provided a perspective that was often aspirational. This encompassed financial considerations and high-level pedagogical shifts. They also spoke at length about the importance of integrating faith-based values into the Learning Environment. Given their managerial role, their responses focused on shaping the overarching framework within which ICT is embedded into the school's curriculum and Special Character.

Principals discussed the financial strains of budgeting for ICT investments and the importance of harmonising ICT use with the core values of Adventist education.

Collectively, these cumulative insights from students, teachers, and principals illustrate the complex relationship between ICT and pedagogy, including the fact that different stakeholders occasionally have different viewpoints, which will be discussed in Chapter 5. As NZ SDA schools adapt to these rapidly changing times, these findings provide evidence and support for ways to overcome challenges and seize the opportunities that effectively utilising ICT enables. These insights can form the basis for informed decision-making, aimed at developing a Learning Environment that equips students for success.

Chapter 5 Discussion

5.1 Introduction

The central objective of this doctoral research has been to investigate the Learning Environment within NZ SDA secondary schools, with a particular emphasis on understanding the role of ICT within those schools. This study also sought to consider how school Learning Environments could be enhanced. This investigation was motivated by the growing national (MOE, 2022d) and international interest in the role of ICT in positively transforming Learning Environments (see Newhouse, 2008b; OECD, 2023a; Wells & O'Riordan, 2021). This was particularly reinforced in the wake of the COVID-19 pandemic, which showed the significant contribution of ICT in enabling learning to continue during a time of great crisis (Ofori Atakorah et al., 2022; Reimers, 2022a; Thorn & Vincent-Lancrin, 2022).

To achieve the above-mentioned research objectives, the perspectives of the major stakeholders, students, teachers, and principals, were captured using a survey and semi-structured interviews. This methodology is widely used in academic research to increase the reliability of findings (Haynes-Brown, 2022a), and is considered best practice in education research (Mielikäinen, 2022; Morcke et al., 2006; Newman & Gough, 2020). By encompassing the viewpoints of these distinct, yet interconnected stakeholder groups, this thesis aimed to answer the following research questions:

1. What is the nature of the Learning Environment in NZ SDA schools?
2. What role and impact does ICT play in supporting the Learning Environment?
3. What needs to be established at the system, school, and classroom levels to enhance the Learning Environment in NZ SDA schools; with a particular emphasis on the role of ICT?

This discussion chapter seeks to synthesise the findings of this research, as reported in Chapter 4, with the scholarly literature. Because of the lack of local scholarly research on the role of ICT in NZ SDA schools, this chapter draws on international literature to contextualise this study's findings and generate insights applicable to the NZ SDA school context. On the

one hand, drawing inferences from global research to understand local realities has its limitations (Armstrong & Kepler, 2018; Wolpin, 2013), such as differences in cultural, institutional, and technological frameworks. At the same time, such inferences can provide a lens through which to interpret the data (Tashakkori & Teddlie, 2008).

5.2 Research Question 1. What Is the Nature of the Learning Environment Established in NZ SDA Schools?

In this section, we discuss the nature of the Learning Environment currently established in NZ SDA schools, drawing on insights from students, teachers, and principals. While these stakeholder groups were found to often agree on the general characteristics of the Learning Environment, there are also differences between the three groups. Through a synthesis of these perspectives, this section aims to provide a starting point for understanding the nature of the Learning Environment in NZ SDA schools. It also covers the implications of the findings on the overall effectiveness of the Learning Environment within NZ SDA schools.

5.2.1 The Learning Environment: Comparisons of Stakeholders' Viewpoints

All stakeholder groups said that the Learning Environment in NZ SDA schools incorporates a wide range of pedagogical strategies, from traditional methods to those that are heavily centred on ICT-incorporated pedagogy. This range reflects the widely researched trend in differentiated pedagogy and the increasing integration of ICT to transform learning experiences and outcomes (Mishra et al., 2021; OECD, 2023a; Tomlinson & Imbeau, 2023). Students emphasised that across these varied pedagogical methods, they frequently receive assistance aimed at facilitating their learning. This focus on student support is important, as there is a substantial body of research that shows that personalised assistance which is readily available can significantly improve student engagement and academic achievement (Gore et al., 2023; Visible Learning, 2023).

Both teachers and principals observed that the Learning Environment is in a state of transition, increasingly shifting toward a greater dependence on ICT. They believe that this shift will result in deeper student engagement with their learning. These perspectives fit well with findings that suggest that effective integration of ICT can create more engaging and

interactive learning experiences (Fisher, 2021b; Newhouse, 2017; OECD, 2023e). However, the teachers were quick to point out that despite the growing use of ICT, the importance of teacher-student relationships is an essential factor in capturing and sustaining student engagement. In addition, teachers mentioned that they play a role in encouraging discussion and creating a positive learning environment. Such an emphasis on establishing meaningful relationships is well-established, especially in positively transforming student motivation and learning outcomes (Knight, 2023; Ryan & Deci, 2022; Wubbels & Brekelmans, 2005).

Both students and teachers perceived that their Learning Environment often provided relevant, real-world learning experiences that helped develop life skills and prepare students for university entrance. However, teachers suggested that there is still room for improvement in this area. They indicate a need for curriculum development that supports the practical needs and aspirations of students. In addition, teachers spoke about the importance of experiential and relevant learning as essential components of effective pedagogy, which has been found in other studies (see Lowell & Moore, 2020; Ramsay-Jordan, 2020; Weng, Chiu, et al., 2022b). Interestingly, principals did not comment on this aspect, which may reflect differing priorities or awareness levels among the stakeholder groups. This disparity highlights that there perhaps needs to be better communication and collaboration among all stakeholders. This is so that curriculum development and pedagogical approaches support the shared goal of optimising student learning.

Teachers and principals highlighted aspects of the Learning Environment that were not prominent or present in student responses. This was specifically around the 'Special Character' of the school system, which is about moral and spiritual development alongside academic achievement. This focus on holistic education is a distinctive feature of NZ SDA schools. It aims to nurture well-rounded individuals, who contribute positively to society (Knight, 2016). While students spoke at length about the practical aspects of their learning with ICT use and its impact on their engagement, the principals and teachers spoke more about the importance of Special Character and building positive relationships. This divergence in perspectives is likely to reflect the roles that these stakeholders play within the Learning Environment.

Students' adaptability during the COVID-19 pandemic was found in the qualitative and quantitative datasets. Survey data revealed that students managed the transition to emergency online learning effectively, with positive responses to the statement "I adapted to learning changes during COVID" (mean = 3.05, SD = 0.947). This adaptability suggests a high level of resilience and flexibility within the student body, as well as the effectiveness of the Learning Environment in supporting students during challenging times (Chandra & Tangen, 2018; Yasmin et al., 2020). Such findings contrast with much of the published literature, which often reports negative experiences during the COVID-19 pandemic, including a decline in student well-being and academic performance (Çavuş, 2023; Di Pietro, 2023). The positive experiences of NZ SDA students during this period, it would seem, highlight the successful strategies of these schools in managing the educational challenges created because of the COVID-19 pandemic.

All stakeholder groups highlighted that ICT plays a significant role in the Learning Environment, with students expressing appreciation for how ICT deepens their engagement. Teachers observed that ICT is often used effectively to enable the gathering of information, which is a function of ICT that has been found to be used widely by students to increase the efficiency of finding content (Costa et al., 2021; OECD, 2023d, 2023e). Principals, however, had a high-level perspective in viewing ICT as being integrated across many aspects of the learning process. They also pointed out the financial constraints that limit the acquisition of new technology, a challenge described in studies that discuss the digital divide and its impact on educational equity (A. R. Golden et al., 2023; Harvey et al., 2023; Zhao, 2024).

The variability in ICT usage across different teachers, as observed by students, suggests an inconsistency in the integration of ICT that could hinder the effectiveness of the Learning Environment. Students recommended that some teachers could benefit from professional development in the use of ICT, a suggestion that is often repeated in the literature on the importance of ongoing teacher training to ensure effective technology integration (Brantley-Dias & Ertmer, 2013; Gore et al., 2023; Nazaretsky et al., 2022). Therefore, establishing effective professional development could increase teachers' ICT capability, resulting in the more effective use of ICT within the Learning Environment.

The data from discussions with teachers and principals also revealed that while ICT use has increased collaboration between students, and between students and teachers, there is still considerable progress to be made before achieving a well-functioning and self-sustaining collaborative culture. Research indicates that while digital technology can facilitate collaboration, the success of such initiatives often depends on how well it is integrated into pedagogical practices (Lindner & Webb, 2022; Zhang, Cao, et al., 2022). Teachers also expressed a desire to have equal student participation. This is an issue that highlights the need for strategies to uphold inclusivity and equity within the Learning Environment. Strategies such as implementing cooperative learning (Davidson & Major, 2024), assigning specific roles within group activities (Cohen & Lotan, 2014), and utilising ICT in a way that increases equitable engagement have been recommended to address such concerns (Newhouse, 2017; Samarasekara et al., 2024).

The positive perception of the Learning Environment among students, as indicated by survey data, highlights the effectiveness of the current pedagogical practices in NZ SDA schools. Students' active engagement in learning activities is a significant indicator of a quality Learning Environment, as active participation is directly linked to improved academic outcomes (Al Rawashdeh et al., 2021; Hiver et al., 2024). The correlation between a positive Learning Environment and student success is well-established (Cayubit, 2021; Rusticus et al., 2023; Ventura, 2020). Students who perceive their Learning Environment positively are more motivated and perform better academically (Han & Ellis, 2021; Wekerle & Kollar, 2022). Students' positive attitudes towards their education, as reflected in responses to questions like "I do things at school that are good for me" (mean = 3.19, SD = 0.761). It suggests a strong recognition of the value and benefits of their schooling experiences. This finding fits well with the Self-Determination Theory, which suggests that positive self-perception in Learning Environments is linked to increased motivation and academic outcomes (Ryan & Vansteenkiste, 2023).

While there is general agreement among students, teachers, and principals on the essential components of the Learning Environment, the similarities and differences in their perspectives provide insights into both the strengths and areas needing attention. For example, students highlighted the engaging aspects of their classes, whereas teachers focused on pedagogical methods, while the principals mostly spoke about institutional policies and

resources. Understanding these varying viewpoints is important, as it highlights the many factors to consider when running an effective school. It also highlights the importance of addressing the needs and expectations of all stakeholders (Garcia, 2014).

5.2.2 The Learning Environment Characteristics

In synthesising the perspectives of students, teachers, and principals, Research Question 1 aimed to describe the nature of the Learning Environment currently established in NZ SDA schools. The nature of the Learning Environment emerges as a composite of these perspectives, which includes the different insights and experiences of each group.

This synthesis was guided by three principles to ensure a balanced and inclusive representation of the Learning Environment. Firstly, components identified by one or two stakeholder groups were included. This is because the absence of mention by another group does not necessarily imply opposition. Instead, it reflects different orientations or priorities, which is essential in constructing a holistic view of the Learning Environment (Navaridas-Nalda et al., 2020; Qadach et al., 2020; Zhan & Yuan, 2009). Secondly, the functionality of each component was assessed by capturing the evaluations from different stakeholders. This provided a balanced approach that captured the strengths and weaknesses of the Learning Environment as experienced by the research participants. Finally, in cases of conflict or divergence in descriptions, the views of teachers was prioritised, given their everyday interaction with students and direct involvement in implementing plans and policies (Hattie, 2009; Hattie, 2023; Wubbels & Brekelmans, 2005). However, this could lead to insufficient consideration of the 'high-level' insights provided by principals or experiential insights from students, which could lead to a partial understanding of some components (Check & Schutt, 2011; Rigby & Tredway, 2015).

The research participants reported that the Learning Environment in NZ SDA schools includes sixteen major characteristics. These range from the diversity of pedagogical strategies, which span traditional and ICT-centred methods, to the emphasis on strong teacher-student relationships, and the increasing use of ICT.

The Learning Environment included the following characteristics, and was one:

1. That included a range of pedagogical strategies from traditional to ICT-centred.
2. Where teachers mostly provide assistance to facilitate student learning; and this assistance is given across all pedagogical strategies.
3. That rates teacher-student relationships highly to improve student engagement.
4. That encourages discussion and critique.
5. That is in a state of flux and is moving towards greater use of technology, which is perceived to improve student engagement.
6. Where there is considerable use of ICT, the students appreciated this and perceived that student engagement is increased because of this attribute.
7. Where ICT is effectively used to efficiently gather information.
8. Where ICT is sometimes used in the knowledge-building process.
9. Where ICT use varies across teachers and classes.
10. Where the classroom technology is appropriate but to some extent constrained by lack of investment in ICT infrastructure that supports the technology.
11. Where there is student-student and student-teacher collaboration, but it is acknowledged that there is still considerable improvement to be done in this domain.
12. Where teachers struggled with the use of ICT and equal student participation.
13. Where the learning experiences are most often relevant, have real-world context, and give the student the opportunity to develop life skills and university entrance grades.
14. That increases flexibility, adaptability, and resilience in the learning process and provides opportunities for students to develop these characteristics.
15. Where the 'Special Character' of the school system is incorporated into school functioning with a focus on academic, moral, and spiritual development.
16. Where the students rate the environment positively and see it as a safe place to learn.

5.2.2.1 The Learning Environment Model

Having identified the sixteen characteristics above, each was considered within the greater body of literature that informs this study. Sixteen elements were then constructed based on a combination of each characteristic and relevant literature. The 16 elements that make up the Learning Environment model for NZ SDA schools are:

1. Pedagogical Strategies: Range from traditional to ICT-centred
2. Teacher Support: Teachers assist across all pedagogical strategies
3. Teacher-Student Relationships: Relationships enhance engagement
4. Special Character: Integration of academic, moral, and spiritual development
5. Open Dialogue: Dialogue encourages discussion and critique
6. Positive Environment: Students see it as positive and safe
7. State of Flux: Increasing use of technology
8. Appreciation of ICT: Students perceive it increases their engagement
9. Gather Information: Effective ICT use makes this possible
10. ICT Use: ICT is used across learning processes
11. Variability in ICT Use: Varies among teachers and classes
12. Financial: Resources constrain ICT availability and infrastructure
13. Collaboration: ICT use promotes collaboration
14. ICT Participation: Schools struggle with a digital divide and distraction
15. Relevant Learning: ICT use enhances real-world experiences
16. Flexibility: ICT Use promotes flexibility, adaptability, and resilience

These elements were collectively formed into the Learning Environment Model as shown in Figure 5.1. The nature of the Learning Environment, as described by these sixteen elements, encompasses a wide range of pedagogical approaches. These range from traditional methods to those that are ICT-centred. This wide range of elements is an intentional strategy to cater to varied learning styles and aims to equip students with the skills that are perceived by teachers to be important for success. The inclusion of ICT as a core component within these elements mirrors global trends where ICT literacy is increasingly viewed as essential (OECD, 2023e; World Bank, 2022).

A significant feature of this model is the strong emphasis on teacher support across a range of pedagogical methods. The findings highlight that teachers in NZ SDA schools often go out of their way to facilitate student learning, which is viewed as essential for student engagement and success. This is supported by research on the importance of personalised support in improving learning outcomes (Nielsen & KlitmØller, 2021; Yan, 2023). However, reliance on teacher support can be problematic because of the sustainability of this approach, especially when teacher resources are stretched (Hester et al., 2020).

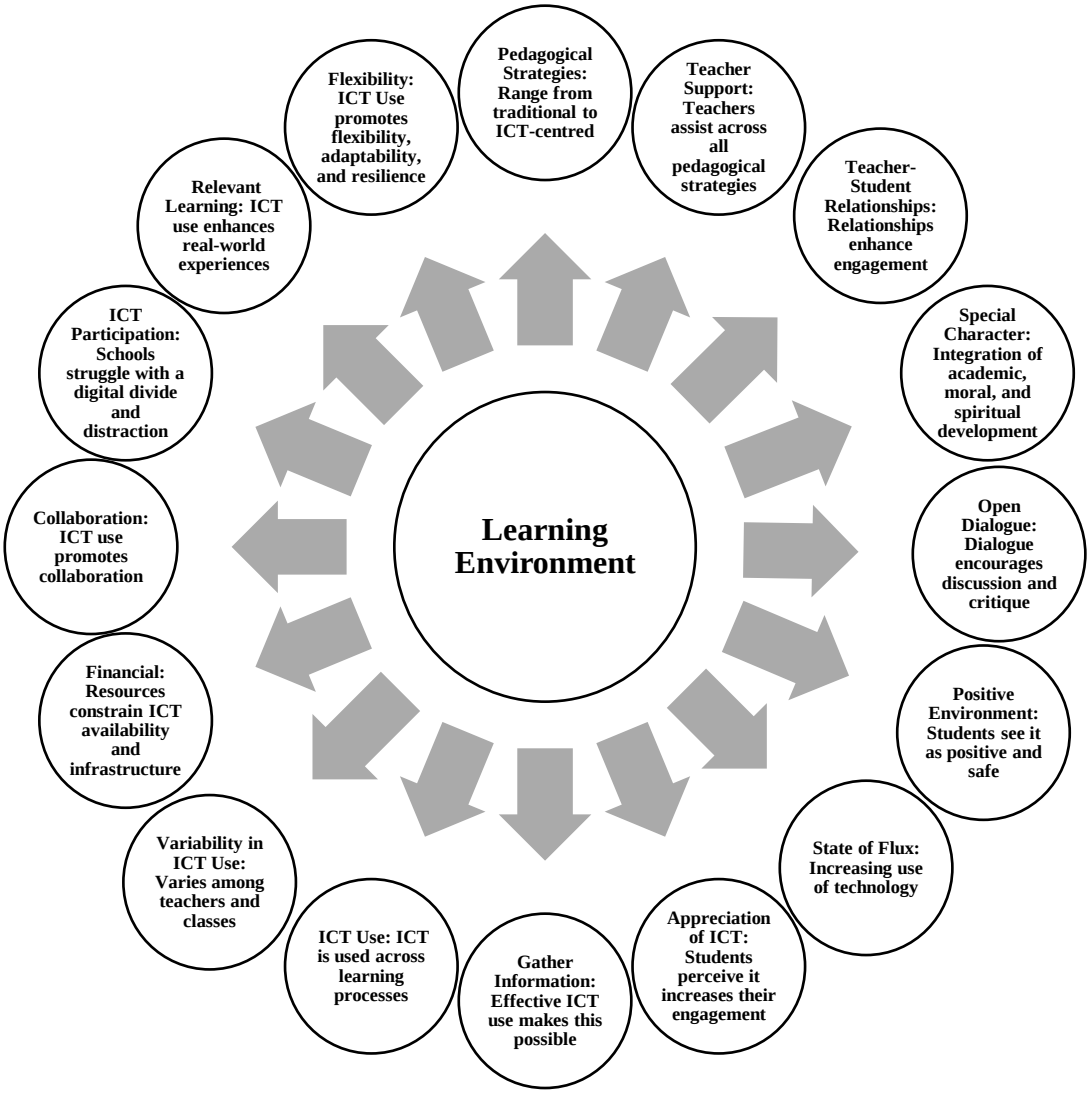

Figure 5.1 Learning Environment Model in NZ SDA Schools

Positive teacher-student relationships are an important part of improving engagement. Such relationships are widely viewed as fundamental to creating a supportive learning atmosphere that often results in high academic achievement (Ellis & Tod, 2018; Roorda et al., 2011; Ryan & Deci, 2022). The emphasis on relationships suggests that the effectiveness of the Learning Environment is heavily dependent on the quality of these interactions.

The model also places a focus on promoting discussion and critique within the Learning Environment. Encouraging open dialogue has been found to be important in developing students' critical thinking skills (Anggraeni et al., 2023; Thornhill-Miller et al., 2023). Intellectual engagement also helps develop a deeper understanding of the subject matter (Gore, 2021; Newhouse, 2016; Parsons & Taylor, 2011). Creating an environment where robust discussion occurs and is actively encouraged has been found to be difficult (Barkley &

Major, 2020), particularly in classrooms where there is a high emphasis on standardised testing (Erstad & Siddiq, 2023) or where teachers may feel unprepared to facilitate such interactions (Norden & Lloyd, 2023).

The Learning Environment is in a state of flux due to the increasing use of technology. As ICT becomes more prevalent, those within the Learning Environment come under pressure to integrate these resources effectively. This ongoing change requires both students and teachers to develop new skills and re-evaluate their pedagogical practice (Newhouse, 2016; Newhouse, 2008b). Students expressed appreciation for ICT, noting that it increases their engagement with the learning material. They highlighted that effective use of ICT enables efficient information gathering, positively transforming their ability to access and process information. For example, students mentioned that online resources enable quicker research and allow for a deeper exploration of subjects.

However, the use of ICT across different classes was found to be variable, with ICT sometimes used in certain subjects but not others. This variability in ICT use across teachers and classes was a source of frustration for students. They expressed a desire for more widespread use of technology in their learning activities. This suggests the need for professional development for teachers to help them effectively integrate ICT within Learning Environments.

Financial constraints were found to play a role in limiting the procurement of ICT affecting the effectiveness of the Learning Environment. Limited budgets can limit access to up-to-date devices, ICT infrastructure, and technical support, which are essential for effective ICT integration (Atolia et al., 2021; Imms & Mahat, 2022; Van Dijk, 2017).

Collaboration, both among students and between students and teachers, was found to be another important aspect of the Learning Environment. While collaborative activities were encouraged, there were challenges with ensuring equal participation among all students. Teachers reported that some students ended up dominating group work, while others may be less engaged. Both students and teachers mentioned the need to improve strategies that increase equitable collaboration.

Teachers emphasised that the learning experiences provided are relevant, helping students develop life skills and prepare for university. They also acknowledged room for improvement in blending these experiences with practical, real-world applications. The Learning Environment encourages the development of flexibility, adaptability, and resilience, which are qualities that have been especially important during challenges such as the COVID-19 pandemic (Chandra, 2021; Harris et al., 2024; Ofori et al., 2023).

Principals and teachers actively support the 'Special Character' of the NZ SDA school system that focuses on academic, moral, and spiritual development, and contributes to a holistic learning experience for students (Knight, 2016). This approach reinforces the values and beliefs that are central to the school's philosophy, which results in creating an environment that supports the overall development of students.

Students generally rated the Learning Environment positively, seeing it as a safe and supportive place to learn. A positive environment is essential for maintaining engagement and motivation, which are the major drivers of academic success (Ryan & Vansteenkiste, 2023; Woo et al., 2024). Therefore, the perception of safety and support indicates that students may feel safe to engage deeply with the content.

5.2.2.2 The Learning Environment: Quality Teaching Framework Reference

The nature of the Learning Environment in NZ SDA schools can be contextualised by examining it through the lens of the Quality Teaching Framework developed by Dr. Jennifer Gore (Gore et al., 2023; Gore, 2021). It is useful to include this framework in the discussion for two main reasons. Firstly, the Quality Teaching Framework provides a holistic and well-established framework for evaluating and understanding teaching quality through its three dimensions: Intellectual Quality, Quality Learning Environment, and Significance (Gore, 2018a; Ladwig & Gore, 2020). These dimensions are central to any Learning Environment, and their relevance persists regardless of the presence or absence of ICT. By grounding the analysis in this framework, it is possible to maintain a focus on the core elements of effective teaching and describe the nature of the Learning Environment. The second point is that even though the framework does not explicitly address digital technology, its principles are applicable to the use of ICT within Learning Environments.

The Intellectual Quality dimension of the Quality Teaching Framework emphasises the importance of promoting 'deep understanding' and 'critical thinking' in students (Gore et al., 2023). It encourages teachers to use pedagogical strategies that connect with students' existing knowledge and encourages higher-order thinking by asking challenging questions and engaging students in substantive, deep, and intellectually stimulating communication (Gore et al., 2023; Patfield & Gore, 2023). Within the NZ SDA schools' Learning Environment, this dimension is not well represented and could be strengthened. Among the elements identified in this study, students are engaged in learning that is often relevant, that has a real-world context, and they deal with problematic knowledge while engaged in discussion and critique. All of these elements contribute to the Intellectual Quality of the Learning Environment, however, there may be a need for more deliberate efforts to integrate deeper intellectual quality across other aspects of the curriculum. This gap could be a significant area for improvement, as developing intellectual rigour is important in preparing students for complex, real-world challenges (OECD, 2018c, 2021d).

The Quality Learning Environment dimension of the Quality Teaching framework focuses on creating classrooms where students feel safe and supported and are encouraged to take risks in their learning (Bowe & Gore, 2016; Gore et al., 2023). For example, students might be encouraged to engage in activities such as making a presentation to their class or tackling advanced topics beyond the standard curriculum, that is, engage in actions that require them to step out of their comfort zone (Gore et al., 2023). This dimension matches three elements of the NZ SDA schools' Learning Environment. For instance, the teacher support across all pedagogical strategies (element 2) and the emphasis on strong teacher-student relationships (element 3). In addition, the presence of flexibility, adaptability, and resilience (element 14) all contribute to creating a supportive and nurturing Learning Environment. These elements suggest that NZ SDA schools are successful in creating environments where students feel secure and are encouraged to engage deeply with their learning. However, stakeholders have observed that there is still room for improvement in providing equitable access to ICT resources.

The Significance dimension of the Quality Teaching Framework, which focuses on making learning relevant to students' lives, is well represented in the NZ SDA schools' Learning

Environment. Elements such as the provision of relevant learning experiences with real-world context (element 13), and the incorporation of the 'Special Character' of the school system (element 15), match with the framework's emphasis on connecting learning to students' current lives and future aspirations (Gore et al., 2023). The integration of faith-based cultural responsivity, alongside national cultural considerations, highlights the importance of making education meaningful and relevant in a holistic sense. While teachers perceive that there is still room for improvement, students rate these aspects highly, indicating a positive reception of the efforts made in this area.

The NZ SDA schools' Learning Environment directly corresponds with many aspects of the Quality Teaching Framework around creating supportive and intellectually significant learning experiences. However, there are areas around Intellectual Quality that could benefit from more attention. Refocusing the curriculum to prioritise intellectual rigour and critical thinking could help bridge this gap (Hattie, 2023; Yan, 2023). By addressing these gaps, NZ SDA schools may improve their Learning Environment in a way that meets the holistic needs of their students and challenges them intellectually in a way that helps them acquire skills that will help them once they leave school.

5.3 Research Question 2. What Role and Impact Does ICT Play in Supporting the Learning Environment?

5.3.1 Introduction

Having discussed the current nature of the Learning Environment in NZ SDA schools, the focus of this discussion now shifts to the second research question, which focuses on the role and impact of ICT within these Learning Environments. The use of ICT in NZ SDA schools is reflective of a global pedagogical trend (Moldagali et al., 2022; Tømte et al., 2020), which the OECD (2023) and the NZ Ministry of Education say is essential in the enhancement of Learning Environments (MOE, 2023).

In the findings of this study, ICT was identified by the participants as a significant factor in shaping student experiences in the Learning Environment. Studies that evaluate global trends have similarly found that a major role and impact of ICT is the extension of learning beyond traditional brick-and-mortar classrooms into remote and ubiquitous forms of learning (Adewale et al., 2024; Baxter & Hainey, 2023; Dhawan, 2020; Hoi et al., 2021). This shift has been highlighted in the findings of this study, where both survey responses and interviews indicated that students and staff saw the role of ICT as one that allows greater flexibility and data accessibility in the learning process. For example, students reported that having access to digital learning environments such as Google Classroom, Moodle and remote lessons via video conferencing allowed them to continue their studies at their own pace, outside the usual school hours, especially during the COVID-19 pandemic lockdowns.

This newfound flexibility and accessibility are not isolated benefits but rather part of a larger transition from traditional didactic pedagogies to a more personalised, ICT-driven pedagogy. The transition from traditional didactic pedagogies, that rely heavily on physical textbooks, pen-and-paper, and a ‘sage-on-stage’ pedagogy (Bobis et al., 2020), to an ICT-based system is not merely a minor evolution of Learning Environments (Cheng, 2019). Rather, it is a fundamental shift in teaching philosophy (Desai et al., 2008; Evans-Greenwood et al., 2015), and a significant challenge within the OECD (OECD, 2023d, 2023e).

This study found that principals, teachers and students faced challenges in adapting to this paradigm shift. These include the preparation required of teachers to create Learning Environments that are more interactive, allowing for greater student engagement and autonomy, which are findings that are similar to those of Cayubit (2022), Dubey et al. (2023), and Topping et al. (2022). ICT provides a plethora of hardware and software resources that enable students to access information, collaborate, and learn in ways that were previously inconceivable (OECD, 2023b, 2023e). Such a transformative environment, when implemented effectively, nurtures critical thinking, creativity, and problem-solving, which are essential 21st-century skills (Elfert & Ydesen, 2023; Erstad & Siddiq, 2023; Mishra & Mehta, 2016; Newhouse, 2017; OECD, 2023e).

5.3.2 The Role and Impact of ICT: Comparisons

Newhouse identified Learning Environment Attributes that were shown to exist when ICT was used in the Learning Environment (Newhouse, 2008b). These attributes are Investigate Reality, Knowledge Building, Active Learning, Authentic Assessment, Engagement, Productivity, High-Level Thinking, Learner Independence, Collaboration and Cooperation, Learning Styles, and Physical Disabilities Equity (Newhouse, 2008b). All of these attributes, to some degree, were reflected in the data relating to the role of ICT in supporting the Learning Environment in NZ SDA schools collected in this study. Although, the data indicated that most of these attributes need ongoing development.

The Investigate Reality attribute focuses on using ICT to help students engage with real-world problems and scenarios, thereby making learning more relevant and applicable (Newhouse, 2008b). In our study, participants emphasised the importance of using ICT to access and analyse information in subjects like science and social studies. For instance, one student spoke about how incorporating data from Google Maps into a geography unit allowed them to investigate climate change in real-time, resulting in a deeper understanding of the subject matter. This category of findings supports Newhouse's (2008) assertion that when students investigate reality through ICT, they can connect theoretical knowledge to practical applications which results in improving their learning experience.

The attribute of Knowledge Building was referred to by all teachers and two principals. Teachers specifically mentioned the role of ICT in helping students construct new knowledge by synthesising information from multiple digital sources. For example, in a social studies class, students used online resources to build a deeper understanding of historical events, which they then presented to the class using ICT. This supports the NISS Framework's view that ICT can be an effective tool for expanding students' knowledge base, allowing them to engage with information more deeply and critically (Newhouse, 2008b).

The Active Learning attribute, which involves students actively participating in their learning process through ICT, is a major finding in this study. This is because teachers reported that using interactive simulations significantly increased student participation and motivation. However, while there was some active learning using ICT, we did not observe, nor did participants mention the use of new technology such as augmented reality, virtual collaboration with experts through video conferencing software like Zoom, Microsoft Teams and Google Meet. This absence indicates a missed opportunity to transform learning experiences and to optimally utilise ICT in enabling deeper engagement and establishing real-world connections. Incorporating these technologies could broaden students' learning horizons by engaging students in immersive learning experiences that corresponds with the Active Learning Attributes (Newhouse, 2008b).

The Engagement attribute, which concerns keeping students motivated and challenged through ICT-enhanced learning experiences, was another area where the participant's views of the role of ICT corresponded with the NISS Framework. Teachers reported that incorporating multimedia elements, such as videos and interactive presentations, into lessons significantly increased student interest and participation. Regarding Productivity, teachers and principals observed that ICT significantly reduced students' time on repetitive, low-level tasks, allowing them to focus on higher-order thinking activities. For instance, Google Docs helped students in an English class concentrate on developing their writing skills rather than being bogged down by manual drafting and editing processes. This use of ICT to increase productivity compliments the NISS Framework's view that technology should support students in maximising their learning efficiency (Newhouse, 2008b).

The High-Level Thinking attribute (Newhouse, 2008b), which involves using ICT to develop students' critical thinking, analysis, synthesis ability and other 21st-century skills was alluded to by a number of students. Five participants reported the use of ICT to enable such tasks as debates, research projects and problem-solving activities. The absence of any mention of the role of ICT in developing High-Level Thinking by both the teachers and the principals is noteworthy. This seems to indicate that this area is not all that high on their priorities and opportunities are being missed for further student development in High-Level Thinking.

The attribute of Learner Independence was particularly highlighted by teachers who reported that ICT allowed students to take greater control of their learning. Six teachers in this study mentioned that online learning websites such as Khan Academy and Mathsbuddy enabled students to progress at their own pace, accessing resources and completing assignments independently. For example, student 3 spoke about self-paced learning used a combination with online tutorials and quizzes to learn calculus concepts ahead of schedule. This finding supports the NISS Framework's assertion that ICT can support individualised learning paths, catering to different learner needs (Newhouse, 2008b).

Collaboration and Cooperation was a major attribute found in this study. Participants spoke about the enabling role of ICT in facilitating cooperative learning, both within and beyond the classroom. For instance, students in a language class used a Google Docs to co-author stories with peers improving their communication and collaborative skills. The use of ICT in enabling collaborative learning corresponds with the NISS Framework's view that ICT can enhance Learning Environments by enabling interactive learning experiences (Newhouse, 2008b).

The Learning Styles attribute, which focuses on tailoring learning experiences to individual student needs, was frequently mentioned by all participants. Teachers and principals said that ICT allowed them to customise instruction to suit individual learning preferences. For example, in a blended Learning Environment, some students preferred video lectures, while others benefited more from teacher instruction. This flexibility in instructional delivery supports the NISS Framework's emphasis on accommodating different learning styles using ICT (Newhouse, 2008b).

Finally, the attribute of Physical Disabilities Equity was highlighted in this study as essential for ensuring all students have equal access to learning opportunities and in which ICT plays a significant role. One teacher mentioned the use of assistive technologies, such as screen readers and speech-to-text software, to support students with physical disabilities. An example given was a student with learning difficulties who completed a research project using a combination of different digital technologies. This demonstrates ICTs ability to help increase inclusivity. This finding corresponds with the NISS Framework's commitment to equity (Newhouse, 2008b).

A closer look at the data from students, teachers, and principals contained similarities and differences in the role and impact of ICT within Learning Environments (see Table 5.1). ICT use was perceived by these stakeholder groups to enhance aspects of the Learning Environment. These enhancements included increased student engagement, improved learner collaboration and customised learning opportunities. It also included knowledge-building, equity for special learners, effective assessment, and the development of 21st-century skills. ICT integration within the Learning Environment was perceived to make learning easier by increasing student productivity and making learning more accessible to the students. Effective communication was also seen to increase, and teachers found that ICT enabled efficiencies in administration. Also, ICT integration within the Learning Environment enabled learning to continue during the COVID-19 pandemic lockdowns.

However, the respondents mentioned that the increasing use of ICT also had some drawbacks. These were the issues around excess screen time, digital distractions, acceptance of inaccurate information from the internet, academic integrity issues, and the impact of limited face-to-face human interaction (see Table 5.1).

Table 5.1 The Impact and Role of ICT in the NZ SDA Schools' Learning Environment

	Students	**Teachers**	**Principals**
Positive Impacts			
Students' Engagement	Enhances	Enhances	-
Collaboration	Enhances	Enhances	Enhances
Tailored learning	Enhances	Enhances	Enhances
Effective communication	-	Enhances	Enhances
Effective assessment	-	Enhances	Enhances
21st-century skills	Enhances	-	-

Special learners' Equity	-	Enhances	-
Knowledge-building	-	Enhances	-
Easy, productive, and accessible learning	Enhances	Enhances	-
Managing students and lesson planning	-	Enhances	-
Learning continuation (e.g. during Covid)	Enhances	-	Enhances
Negative Impacts			
Excess screen time	-	Deterrent	-
Distraction	Deterrent	Deterrent	Deterrent
Inaccurate information	Deterrent	Deterrent	-
Academic dishonesty	-	Deterrent	-
Limits human interaction	-	-	Deterrent

In the interviews, students spent more time talking about the positives of ICT compared to the negatives. From the students' perspective, ICT is valued for its ability to positively transform engagement and enable personalised learning experiences. The use of ICT in the Learning Environment allows for more interactive learning opportunities, which students find both engaging and relevant to their individual needs. This matches the findings of studies on the positive correlation between ICT use and increased student engagement (Gupta & Mishra, 2021; Mishra & Mehta, 2016; Ong & Annamalai, 2023). Furthermore, students particularly appreciate the role of ICT in ensuring continuity of learning during disruptions, as was experienced during the COVID-19 pandemic. The ability to transition to remote Learning Environments was a significant positive outcome for students, highlighting what ICT can enable.

While the students were mostly positive, they acknowledged the harm that digital distraction can cause. It is well-established that digital distractions hinder the ability to focus on learning activities (Flanigan & Babchuk, 2022; Hanin, 2021; Hartley, 2022; Kärki, 2024). The ease of access to entertainment and social media through digital devices often detracts from educational tasks, which may lead to decreased academic performance and lower levels of engagement (Dubey et al., 2023; Samarasekara et al., 2024).

The implications of such findings are significant because, on the one hand, the integration of ICT into Learning Environments is celebrated for its ability to improve engagement, provide access to information, and enable innovative pedagogy (Mishra et al., 2024; OECD, 2023b). The use of software applications can make learning more interactive and relevant to students' lives, leading to deeper understanding and improved academic outcomes (Newhouse, 2008b).

However, there is a downside, which is that the very tools designed to improve learning can also serve as distractions. This can result in a reduction in the effectiveness of the Learning Environment (Hanin, 2021; Hartley, 2022; Kärki, 2024).

The balance between maximising the benefits of ICT and managing its shortcomings is an area of current academic interest (Flanigan & Babchuk, 2022; Han et al., 2024; Kärki, 2024). From a positive perspective, ICT can empower students by providing them with the tools to access information, collaborate with peers, and engage in self-directed learning. Participants in this study reported that when used effectively, these technologies can support personalised learning experiences that cater to individual student needs, thereby increasing engagement and motivation. The ability to simulate real-world scenarios and provide immediate feedback can improve the learning process, making it more relatable and responsive to student needs (Dare et al., 2021).

On the other hand, the pervasive nature of digital distractions cannot be ignored (Hanin, 2021; Hartley, 2022). The findings from this study suggest that without appropriate supervision and guidance, students may struggle to maintain focus on their academic work. This may lead to lower levels of engagement and poorer academic outcomes. This is relevant because students are used to multitasking and having constant digital connectivity. It falls upon teachers to mitigate these distractions while leveraging the advantages of ICT.

Despite the hindrances caused by digital distraction, teachers in this study viewed ICT as an effective tool for improving collaboration and knowledge-building. From their perspective, ICT supports student engagement and provides many software applications for managing classroom activities and planning lessons more effectively. This validates research that highlights the role of ICT in improving instructional practices and facilitating differentiated learning (Ottenbreit-Leftwich et al., 2023; Sackstein et al., 2022). Teachers also emphasised the importance of ICT in creating personalised learning experiences that address the increasingly varied needs of students, including those requiring special attention due to their unique learning needs.

However, teachers also spoke about the negative impacts of ICT in relation to excess screen time, the acceptance of inaccurate information, and academic dishonesty. Prolonged

exposure to screens is associated with serious health risks, including eye strain and reduced physical activity, which can adversely affect students' well-being (Grimes & White, 2019; Li et al., 2022). The vast amount of false information available online can sometimes lead students to use unreliable sources (Barzilai et al., 2023; Ojha et al., 2023). The ease of accessing information online may lead to issues of academic integrity particularly around plagiarism (Desiron & Petko, 2023; Peytcheva-Forsyth et al., 2018). These issues highlight the need for careful consideration of how ICT is integrated into the Learning Environment to ensure that its benefits are maximised while minimising its shortcomings.

Principals, who often have a macro-level perspective, shared some of the positive views held by teachers. These views were situated around the improvement in collaboration and the facilitation of personalised learning through ICT. They also recognised the importance of ICT in maintaining learning continuity during disruptions. This, they highlighted, was particularly of value during the COVID-19 pandemic. However, principals were also concerned with the negative effects of ICT use.

One significant concern for principals is the impact of ICT on human interaction within the school community. They worried that excessive reliance on technology may erode the quality of interpersonal relationships between students and teachers, as well as among students themselves. This concern is supported by research suggesting that increased screen time can reduce face-to-face interactions, which are essential for developing social skills and community (Kerai et al., 2022; Tak & Catsambis, 2023; Williamson, 2024). Principals were also mindful of the potential of ICT to create interpersonal conflict between students. They spoke about the need for policies that ensure technology supports learning, rather than works against it.

The varying perspectives of students, teachers, and principals on the role and impact of ICT highlight the range of factors to consider when integrating ICT into the Learning Environment. Each group's views reflect their different experiences and priorities within the Learning Environment, leading to differing opinions on how ICT should be utilised. These divergent perspectives highlight the need for a balanced strategy for ICT integration that considers the differing needs and expectations of all stakeholders (Newhouse, 2008b; OECD, 2023e). The implication is that successful ICT implementation requires technological

resources, effective communication, and collaboration among students, teachers, and principals to develop a shared vision for its use. In other words, a whole of school approach is needed, which is a major feature of the NISS Framework (Newhouse, 2008b). This study suggests that without a whole-of-school approach, the potential of ICT to enhance learning outcomes may not be realised, leading to underutilisation or resistance from one or more groups.

For example, students in this study focused on engagement and accessibility, often asking for increased use of digital technology in a way that supports their learning preferences. In contrast, teachers, who are more attuned to the instructional challenges, spoke about pedagogical strategies that improve learning without compromising academic integrity and mitigating digital distraction. Principals were more concerned with the overall functioning of the school, risk mitigation, and the long-term implications of ICT on the school's Special Character. They spoke about the need for policies and plans that address the negatives of excessive ICT use, such as diminished human interaction and increased distraction.

These differing perspectives highlight the importance of collaboration in ICT integration, where the insights of each stakeholder group are considered in decision-making processes. Effective ICT integration requires that the benefits, such as improved engagement and personalised learning are maximised. While the risks, including distraction, academic dishonesty, and reduced social media interaction, are mitigated through appropriate safeguards (Fisher, 2021a; Imms & Mahat, 2022).

5.3.3 The Role and Impact of ICT: A Transformative Tool

As discussed in Chapter 2, the SAMR model (Puentedura, 2010) categorises the levels of classroom ICT implementation from Substitution to Redefinition. While the two lower levels (Substitution and Augmentation) of the model can enhance learning, the top two levels (Modification and Redefinition) can transform learning outcomes only when ICT is effectively implemented. The results of this study reflect this structure. ICT was perceived by all stakeholders as an effective tool that transformed six major aspects of the Learning Environment. For example, study participants reported that ICT can be used to engage students in active learning, facilitate collaboration, knowledge-building, effective assessment,

increase student autonomy, and tailor learning to meet students' needs by facilitating project-based collaborative work and extending learning beyond the classroom. Each of these uses will now be discussed.

5.3.3.1 ICT Can Be Used to Engage Students in Active Learning

One of the major findings of this study was the transformative role that ICT played in engaging students in active learning. The increasing integration of ICT within the Learning Environment was widely perceived by all stakeholder groups: students, teachers, and principals, as a tool that could significantly improve student engagement and participation in the learning process. Active learning, characterised by high levels of student involvement and direct participation (Michael, 2006), was often highlighted as being enabled through the effective use of digital technologies. This is in agreement with a large body of literature that has found that the integration of ICT can substantially improve the effectiveness of active learning strategies (Chugh et al., 2023; Murillo-Zamorano et al., 2021; Roehl et al., 2013; Tondeur et al., 2021).

Student responses in this study revealed high levels of satisfaction with the active use of ICT in their learning activities. This was most obvious around ICT's ability to enable more interactive and engaging classroom experiences. Students frequently cited examples where technology allowed them to actively participate in lessons, such as through interactive simulations, online discussions, and collaboration-enabling software such as Google Workspace and Office 365. This preference for pedagogy that incorporates ICT corresponds with constructivist learning theories, which emphasise that students construct knowledge more effectively when they are actively engaged, and when learning is contextualised within their own experiences (Barrouillet, 2015; Piaget, 1973).

For example, students mentioned that their involvement in ICT-based interactive simulations provides a way for them to manipulate variables and see the immediate consequences of their actions. For example, Student 8 spoke about a program called Newton, which they used in physics to simulate experiments, resulting in a deeper understanding of complicated concepts through experiential learning. This matches Piaget's theory on cognitive development through active discovery and hands-on learning experiences (Piaget, 1973; Shayer, 2003).

Similarly, students reported that online discussions encouraged them to articulate their thoughts, question assumptions, and build on the ideas of others. This reflects Vygotsky's concept of social constructivism, where learning is seen as a socially mediated process (Vygotsky & Cole, 1978).

These findings suggest that ICT can support constructivist pedagogy. This is of significance within the Learning Environment in NZ SDA schools, where the research participants highlighted that there is an emphasis on constructivist-based, student-centred learning. Therefore, by effectively incorporating digital learning material using constructivist principles in an active manner, teachers can create Learning Environments that engage students and develop deeper understanding and retention of knowledge.

In addition, these findings reflect the NISS framework (previously discussed in Chapter 2), which emphasises the use of ICT to support varied and challenging learning experiences, thus improving intellectual quality and student engagement (Newhouse, 2008b). These findings parallel the Quality Teaching Framework, which emphasises the importance of creating a Learning Environment that develops intellectual quality, relevance, and significance (Gore et al., 2023; Patfield & Gore, 2023). By integrating ICT in ways that support active, constructivist learning, educators in NZ SDA schools could fulfil the principles of both frameworks, thereby optimising the learning experience and outcomes for their students.

Furthermore, the way teachers integrate technology into their pedagogical practices is in line with scholarly literature on teachers' roles in facilitating meaningful learning experiences (Gore et al., 2023; Hajovsky et al., 2020; Kraft et al., 2020; Visible Learning, 2023). While some teachers expressed reservations about their technical ICT capabilities, overall, they possess the competence to use digital technology in their teaching. This agrees with literature that states that teachers often report feeling not confident in their ability to utilise technology given they are not digital natives and are not experts in every aspect of its functionality (Ottenbreit-Leftwich et al., 2018; Tondeur, Scherer, Baran, et al., 2019; Tondeur, Scherer, Siddiq, et al., 2019).

Teachers in this study reported a willingness to use ICT within the Learning Environment and illustrated their desire to adapt to the needs of their students. According to the literature,

this is a component of effective pedagogy (Mishra et al., 2024; Silva et al., 2021). The willingness of teachers to experiment with using ICT supports the theoretical underpinnings of active learning (Morris & Rohs, 2023), and may also provide practical benefits that support NZ SDA schools' goals of being innovative and future-focused (Lim & Forsey, 2023; Nielsen, 2023).

Teachers and principals in this study emphasised their commitment to constructivist pedagogies, which engage students in active learning, thereby facilitating an explorative learning experience. The effectiveness of integrating constructivist methods with ICT is highlighted by Hatch (2023) and Reid-Martinez and Grooms (2021), who found that such integration positively transforms the learning process. The use of ICT, as found in this study, to provide interactive and engaging learning experiences corresponds with constructivist theories as it may enable students to experiment and study concepts in an active manner (Chaudhary & Nagar, 2018b; Mlambo et al., 2020).

However, the application of constructivist principles within Learning Environments that incorporate ICT in NZ SDA schools has not been a focus of research to date. Investigating this gap could provide useful insights, as the application of these principles in technology-rich Learning Environments has been shown to improve student outcomes (Kim & Adlof, 2024; Moon et al., 2021; O'Connor, 2022). Exploring this could validate the effectiveness of constructivism in ICT-incorporated Learning Environments, and guide future policies and practices within these institutions.

Although the term 'constructivism' was not explicitly used by students during interviews, their responses indicate a preference for Learning Environments that have constructivist characteristics. Students spoke positively about the integration of ICT in learning, noting how engaging it is when teachers conduct lessons that include hands-on learning experiences. Such preferences fit well with constructivist principles on collaborative and interactive learning that effectively utilise ICT (Dubey et al., 2023; Hiver et al., 2024; OECD, 2023e). For example, the use of software applications, like Google Classroom and Microsoft SharePoint, which allow students to access educational resources from any location, supports independence and self-directed learning (Gupta & Pathania, 2021; Humeniuk & Romaniuk, 2023; Lemmetty & Collin, 2020). These capabilities are important enablers for lifelong

learning (Ayse, 2018), and highlight the transformative effect of integrating ICT within the framework of Adventist education's commitment to holistic student development (Knight, 2023).

5.3.3.2 ICT Can Be Used to Facilitate Collaboration, Knowledge-Building, and Effective Assessment

Teachers highlighted ICT's role in transforming collaboration, knowledge-building, and effective assessment. They recognised that ICT supported student engagement and provided effective ways to keep track of classroom activities and plan lessons. ICT enabled teachers to create personalised learning experiences that catered to the varied needs of students, including those with special needs. The ability to enable easy communication both within the classroom and between home and school was highlighted. This agrees with the TPACK framework, which emphasises the integration of digital technology into pedagogical content knowledge to improve academic outcomes (Mishra & Koehler, 2006; Mishra et al., 2023) (Koehler & Mishra, 2009).

Principals shared most of the positive views held by teachers on the collaboration and the facilitation of personalised learning enabled by ICT. They also recognised the importance of ICT in maintaining learning continuity during the COVID-19 disruptions. However, principals appeared more concerned with the risks of ICT for the school as an institution, in particular, negative publicity. This focus on institutional risks is reflected in the literature, where school leaders prioritise issues such as data security and online safety (Weiner et al., 2021). They were less focused on the day-to-day instructional benefits and more on risk mitigation. The principals were also focused on wanting ICT integration to be in harmony with the school's Special Character. This perspective reflected a more strategic view of ICT, considering both its ability to support school-wide initiatives and the risks associated with its implementation.

Students also spoke about the advantages of ICT in enhancing collaboration, knowledge-building, and assessment processes. They reported that ICT enabled group projects by allowing real-time communication and resource sharing, which made collaborative tasks more efficient and engaging. In addition, students appreciated the immediate feedback

provided through online assessments, which helped them to promptly identify areas for improvement. However, students also spoke about a lack of access to devices and the potential for digital distractions. This indicates that while ICT offers significant benefits, there are issues that need to be addressed to ensure equitable and effective use. These insights suggest that successful ICT integration requires hardware, software and strategies that support all stakeholders.

5.3.3.3 ICT Can Be Used in Promoting Student Autonomy

One of the major findings of this study is the transforming role of ICT in promoting student autonomy within the Learning Environment of NZ SDA schools. Both students and teachers recognised the value of ICT in enabling independence through collaborative and self-directed learning tasks. Teachers reported that ICT bolsters student engagement and the development of essential skills, such as effective communication, critical thinking, and self-regulation, which, in turn, helps students to become more autonomous and take ownership of their learning (Dever et al., 2024; Henderson & Cunningham, 2023). The ability of students to collaborate through ICT-based learning platforms, such as shared documents and online discussion forums, further provides a means to be independent as they engage in peer-to-peer learning and problem-solving activities without direct teacher intervention.

The use of ICT in promoting student autonomy has been a focus of scholarly research (Basri, 2023; Tsai, 2021). Studies have shown that ICT plays a significant role in supporting learner independence and creating personalised learning experiences (Marougkas et al., 2024; Taylor et al., 2021; Watters, 2023). By providing students with the tools to access learning material and collaborate on projects at their own pace (Han et al., 2023), ICT encourages a transition from teacher-centred instruction to student-centred learning (Bremner et al., 2022). This transition can help develop lifelong learners who are better equipped to adapt to the demands of the 21st-century (Erstad & Siddiq, 2023; Thornhill-Miller et al., 2023).

This study highlighted some differences in how students and teachers perceive the role of ICT in promoting autonomy. While teachers emphasised the development of critical thinking and self-regulation, students were more focused on the immediate benefits of engagement and collaboration. This difference in perspective suggests that while ICT can be used to

develop autonomy, its effectiveness may be influenced by how it is framed and supported within the Learning Environment. Therefore, teachers need to be mindful of these differing perceptions and work to develop pedagogy that supports the goal of developing autonomy.

5.3.3.4 The Use of ICT Can Tailor Learning to Meet Students' Needs

This study found that ICT can play a transforming role in tailoring learning experiences to meet individual student needs within the Learning Environments of NZ SDA schools. According to the data collected from students, teachers, and principals, the strategic use of ICT is integral to customising the Learning Environment to suit students, thereby improving the Learning Environment's relevance and effectiveness. This agrees with literature that ICT within innovative learning environments is often utilised as an enabler of personalised and interactive learning experiences (Imms & Mahat, 2022; Marougkas et al., 2024). Within NZ SDA schools, this personalisation is achieved using collaborative software applications, such as Google Classroom, Microsoft Teams, Zoom, and Google Meet, which enable teachers to adapt content and instructional methods to support students' preferences and learning needs.

Teachers reported that ICT enabled them to be attuned to the learning needs of their students. Students emphasised similar opinions, noting that interactive learning experiences enabled by these technologies are markedly more engaging. Beyond engagement, ICT has expanded students' scope of research capabilities and information retrieval, granting them access to a range of information sources beyond traditional educational materials. The findings highlight ICT's enabling role in improving learning outcomes, which is a theme that is extensively supported by academic research (Marougkas et al., 2024; Mishra et al., 2024; OECD, 2023a).

By effectively incorporating ICT, teachers can provide more engaging, relevant, and personalised learning experiences (Adewale et al., 2024; Aparicio et al., 2021). Furthermore, equipping students with ICT is increasingly being seen as important for success (OECD, 2022a; Wells & O'Riordan, 2021). This theme also supports the NISS framework (Newhouse, 2008b), highlighting that quality Learning Environments are ones where digital technology use results in active, collaborative, and flexible learning. As pedagogy evolves, digital technology integration may help teachers effectively meet students' needs (MOE, 2022c, 2022d). Emerging technologies, like artificial intelligence (Adıgüzel et al., 2023;

Schmidt-Crawford et al., 2023), gamification (Zeybek & Saygı, 2024), augmented reality (Buchner et al., 2022), and virtual reality (Dincelli & Yayla, 2022), have the potential to improve Learning Environments (OECD, 2022b). These technologies may enable unprecedented opportunities for creating immersive and personalised learning experiences, thus corroborating the findings from the interviews conducted in this study.

All the participant groups in this study have a collective aspiration to utilise ICT to redefine and transform pedagogy. While the advantages of ICT are widely acknowledged (OECD, 2023e), a significant challenge persists in effectively utilising these technologies to improve pedagogy. These challenges have been extensively researched (Byers et al., 2018; Fisher, 2021b; Morris & Imms, 2024). For instance, while gamification is proven to increase motivation and engagement (Zeybek & Saygı, 2024), some teachers struggle with implementing it in ways that deliver on curriculum goals (Tak & Catsambis, 2023). Similarly, while AI can provide personalised learning paths, teachers often face a steep learning curve in effectively evaluating the data it generates and using it effectively to inform their instruction (Adıgüzel et al., 2023; Mishra et al., 2024). Furthermore, integrating augmented and virtual reality into classrooms requires overcoming implementation challenges, such as cost and access to equipment (Buchner et al., 2022; Dincelli & Yayla, 2022). These barriers were mentioned in the interviews, where both principals and teachers discussed the financial and logistical challenges of procuring and utilising ICT. These examples demonstrate that while the benefits of ICT are acknowledged, actualising this would require overcoming the barriers associated with resource availability, teacher training, and practical application.

As a result, both students and teachers reported that the current use of ICT within the Learning Environment is often limited to replacing traditional tools like pen and paper, or serving basic information retrieval functions, rather than fundamentally transforming pedagogical strategies. The academic literature provides strategies for meeting such challenges. For example, the Quality Teaching Rounds project emphasises the importance of ongoing professional development for educators, with many examples indicating that such initiatives are successful in equipping teachers with the necessary skills to effectively incorporate new technologies, and adapt their teaching strategies to the changing needs of students (Gore et al., 2023; Gore, 2021; Harris, Jaremus, et al., 2024; Sok & Heng, 2024).

This limitation in the current use of ICT highlights an opportunity for a strategic shift in how digital technology is utilised in the Learning Environment. The Quality Teaching Rounds provides a compelling and tested model, demonstrating the effectiveness of professional development that extends beyond traditional training (Gore et al., 2023; Gore, 2021). By engaging educators in ongoing professional development, helps bridge the gap between simple technology substitution and genuine pedagogical transformation (Patfield et al., 2023; Zdanevych et al., 2024). This is important for the effective use of ICT as a transformative educational tool as opposed to a digital replacement of traditional methods.

5.3.3.4.1 The Use of ICT Can Facilitate Project-Based Collaborative Work

The role of ICT in transforming learning by facilitating project-based collaborative work emerged as a significant theme in this study, with students, teachers, and principals all emphasising its importance. They identified how such collaboration encourages independent learning, creative thinking, and is necessary in developing 21st-century skills. These also include skills such as communication, teamwork, and digital literacy (Erstad & Siddiq, 2023; Ng, Leung, Su, et al., 2023). This agrees with other studies that have similarly found the importance of ICT in enhancing these competencies (Marin-Zapata et al., 2022; Oberländer et al., 2020; Ryan et al., 2024).

Furthermore, the emphasis on developing soft skills such as teamwork (Soboleva & Karavaev, 2020) and communication skills (Danao, 2024) through these pedagogies, is becoming more relevant in our ICT-driven society (Touloumakos, 2020). As pointed out by Varas et al. (2023), World Economic Forum (2023), the job market, which is becoming increasingly dependent on ICT, requires a workforce adept in technical skills and soft skills (Danao, 2024). In NZ SDA schools, using ICT in collaborative projects can give students the opportunity to develop these soft skills. Studies have shown that collaborative, project-based learning is particularly well-suited to meet this need, as it helps with the development of these soft skills (Zhongmei Han et al., 2023; Owens & Hite, 2022).

The active, hands-on strategy of project-based pedagogies, as Wang (2020) and Yannier et al. (2021) point out, engages students in real-world challenges, and enables a deeper

understanding and practical application of knowledge (Hwang et al., 2020; Yannier et al., 2021). This method contrasts with traditional rote learning techniques, allowing students to examine and benefit from learning material in a more active and self-directed manner (Fisher, 2021a; Imms & Mahat, 2022). Students involved in such activities are more likely to retain information and develop a thorough understanding of the subject matter (Sabah, 2023). For example, Student 9 said, "I think technology helps it because whenever we work in groups, we have to share documents and everything … So, it makes it a lot easier. And we do use technology whenever we're in groups."

However, there are some drawbacks associated with collaborative project-based learning (Foster, 2022; Hussein, 2021), such as individual accountability within groups (Almulla, 2020; Lin & You, 2021). In addition, Capdeferro and Romero (2012) and Radkowitsch et al. (2020), argue that without careful oversight, some students might not get adequate attention, leading to a situation where they might 'fall between the cracks' in group work. These challenges highlight the importance of designing collaborative Learning Environments that encourage teamwork and cater to individual learning needs. The Literature says that teachers need to consider and implement strategies that encourage equal participation, such as clearly defining roles while also establishing individual responsibilities (Fung & Liang, 2023; Vogel & Wood, 2023).

Teachers in this study also expressed that it was difficult to grade collaborative learning projects. They spoke about the difficulties involved in evaluating individual contributions within groups. Scholars have highlighted that assessing collaborative work can be complicated, resulting in issues around the fairness and accuracy of evaluations (Jaiswal et al., 2021; Nieminen et al., 2023). Therefore, developing authentic assessment strategies that accurately reflect individual student contributions and learning outcomes is needed (Grant et al., 2021; Palladino & Shepard, 2023). This is so that there is fairness that mitigates dominance by more assertive group members.

5.3.3.4.2 The Use of ICT Can Extend Learning Beyond the Classroom

It is well-established that ICT's influence extends far beyond the relocation of learning spaces (Byers et al., 2018; Imms et al., 2016a). Instead, it can transform the Learning

Environment by increasing the quality of instructional content (Gentile et al., 2023; Lomos et al., 2023a). This enhancement is observed in the way digital technologies have increased accessibility (Aydemir et al., 2015), engagement (Zhongmei Han et al., 2023), and diversity of learning material (Dursun et al., 2021; Jeffs & Morrison, 2005). ICT has enabled educators to create more interactive, and personalised learning experiences, catering to the increasingly varied needs of students (Imms & Mahat, 2022). These digital technologies have allowed for the integration of artificial intelligence, virtual reality, multimedia resources, online collaborations, and real-time feedback, thereby making learning more engaging and effective (Ouyang & Jiao, 2021; Zhai et al., 2021).

ICT has significantly transformed pedagogy, especially by moving it beyond traditional classroom confines. There is a substantial body of literature on the role of ICT in this paradigm shift (Bozkurt et al., 2023; Mishra et al., 2024; Muller et al., 2023; OECD, 2023a). This study contributes to the discourse by finding a strong consensus among principals, teachers, and students on the role ICT is playing, and can further play, in redefining the Learning Environment within SDA schools. In particular, this shift, moving from the limitations of physical classrooms to remote, flipped, and blended Learning Environments, gained particular prominence during the COVID-19 pandemic, which research indicates has redefined education worldwide (Ellerbrock, 2024; Harris, Chen, et al., 2024; Werner & Woessmann, 2023).

This study found that the shift brought about by the COVID-19 Pandemic has had a significant influence on NZ SDA schools, the major one being increased ICT usage that principals and teachers said would not have occurred otherwise. Principals within the surveyed schools expressed a positive view of hybrid learning, recognising its benefits, especially around resource allocation. Furthermore, teachers reported a significant increase in their comfort with using ICT, acknowledging the substantial advantages these technologies bring to their teaching practices. In addition, students spoke at length about their desire for ICT to be embedded into their workflow. These perspectives highlight an acceptance and readiness for further integration of ICT into their pedagogy.

The COVID-19 pandemic's impact on education highlighted the versatility and necessity of ICT in maintaining the continuity of learning (Ofori et al., 2023; Ofori Atakorah et al., 2022).

As educational institutions worldwide were subjected to unprecedented lockdown-related challenges, ICT emerged as ‘a saviour’ for maintaining educational delivery (Espino-Díaz et al., 2020; Lorente et al., 2020; Schleicher, 2020). When effectively implemented, remote and blended learning can provide an enhanced learning experience (Topping et al., 2022; Werner & Woessmann, 2023). The findings of this study agree with the above-mentioned findings that despite the difficulties arising from the emergency shift to remote learning, students in NZ SDA schools expressed an overall positive experience.

According to students, teachers, and principals, as they reflected from a post-COVID-19 lockdown position, the experiences and lessons learned during the emergency remote teaching phase have had a lasting impact. Students reported that they could adapt to remote learning conditions. Teachers reported an increased comfort and proficiency with digital technology, recognising their capability to use it effectively in their teaching practices. However, they also highlighted the necessity for more professional development to better utilise ICT. There is an understanding that while the curriculum may require adjustments to accommodate these changes, there is a newfound confidence among educators that such a transformation can occur. This shift in perspective marks a significant change in the use of digital technology within learning environments, indicating a possibly more technology-embedded future, especially post-COVID-19 lockdowns.

The change observed in this study corresponds with other research, which indicates that teachers are becoming more proficient in utilising ICT (Grierson et al., 2024; Selwyn et al., 2017; Sembiring, 2022; Winter et al., 2021). Researchers have observed that the shift to remote teaching because of the COVID-19 pandemic lockdowns significantly accelerated teachers’ digital literacy in their ability to integrate ICT into their pedagogical practices (Ewing & Cooper, 2021; Farkhani et al., 2022; Suh et al., 2022).

Furthermore, research by Greenhow et al. (2021) points out that this sudden shift into online learning has led to a greater acceptance of ICT. This agrees with our findings, suggesting a shared global experience among educators who are coping with the transition to more technology-intensive teaching methodologies (Harris, Chen, et al., 2024; Ofori Atakorah et al., 2022). Such insights highlight the changing nature of pedagogy in the post-pandemic era and reflect a shift towards more significant usage of ICT within the Learning Environment.

The growing incorporation of ICT within Learning Environments mirrors global trends in prioritising digital literacy and preparing students for a technology-centric future (OECD, 2023d; Rakha, 2023; UNICEF, 2021). In this context, ICT does more than its traditional role as a way to access knowledge (Bobis et al., 2020); it has become an important 'tool' in equipping students with essential skills for success in the workforce (Erstad & Siddiq, 2023). This trend indicates an understanding of digital proficiency in contemporary education (Lucas et al., 2022). As schools recognise and adapt to these changes, ICT-integrated pedagogy is increasingly viewed as central in developing future-ready students, capable of managing and contributing to a more digitised society (OECD, 2023b, 2023e).

The experiences during the COVID-19 pandemic have changed Learning Environments. This transformation is characterised by increased acceptance of ICT and greater digital literacy among educators. However, it has also highlighted a need for continuous professional development in ICT, and a willingness to revise and update curricular content, incorporating the enabling qualities of ICT. While the COVID-19 pandemic accelerated the use of ICT, scholars have said that this is not only a response to a temporary crisis. It is a reflection of a global shift towards a more digitally literate and ICT-equipped society (OECD, 2022b, 2023a, 2023e). The role of ICT will continue to be central (MOE, 2022d) in improving student outcomes by equipping learners with the skills that prepare them for the future (OECD, 2023e).

Our findings suggest that the integration of ICT in the Learning Environments in NZ SDA schools is likely to remain a permanent fixture, driven by both necessity and the recognition of its benefits. The increased comfort and proficiency with ICT among teachers, as reported in this study, suggests that all stakeholders are adapting to ICT being integral to their pedagogy. This shift indicates a move towards a more hybrid and flexible approach that has transformed Learning Environments that can now better cater to the increasingly varied needs of students. The readiness and desire of students to have ICT embedded into their workflow further reinforce the idea that digital tools are now seen as essential components of the learning process rather than supplementary aids.

This shift extends beyond the immediate learning context. As society becomes more dependent on ICT, the skills and competencies required to effectively participate in society is rapidly changing (OECD, 2023d). Our study highlights that by integrating ICT into their teaching practices, educators are at times succeeding in transforming the learning experience, equipping students with the digital literacy and critical thinking skills that is most likely to be necessary for success in the 21st-century. This corresponds with the global shift towards preparing learners for the future (MIBE, 2022; OECD, 2022a).

The implications of this shift are particularly relevant in the context of global trends. The COVID-19 pandemic has highlighted and, in many cases, exacerbated existing inequalities (Cheshmehzangi et al., 2023). Our findings suggest that as NZ SDA schools continue to integrate ICT into their curricula, there will likely be a need for ongoing investment in digital infrastructure and professional development for educators to ensure that all students can benefit from ICT. Urgently addressing these disparities has been described as an essential part of preventing the 'leaving behind' of the most vulnerable learners (Acilar & Sæbø, 2023; Golden et al., 2023).

5.3.3.5 There Are Some Areas of Concern with the Use of ICT

Despite the many advantages of ICT, significant areas of concern were also identified. Three main concerns among students and teachers were the digital divide, cognitive overload and digital distraction. The constant availability of information and the allure of digital entertainment could easily overwhelm students or divert their focus from educational tasks, leading to decreased academic performance (Flanigan et al., 2023; Hartley, 2022; Kärki, 2024). This issue can be particularly problematic in environments where students are still developing self-regulation and time-management skills (Flanigan & Babchuk, 2022; Hanin, 2021). The NISS framework warns that one should be mindful of over-reliance on digital technology, which can lead to shallow learning experiences if not properly managed (Newhouse, 2008b).

A major issue raised in the findings is the digital divide. While ICT can improve learning for many students, it also exacerbates inequalities. This digital divide includes disparities in access to devices, internet connectivity, and digital literacy skills, which can hinder some

students' abilities to make the most of ICT-enhanced learning (Cheshmehzangi et al., 2023; Harvey et al., 2023). As highlighted by all stakeholders in this study, this concern is especially relevant in the context of NZ SDA schools, where variations in socioeconomic status among students lead to differing levels of access to ICT resources. Much has been written about this concern, particularly around how the digital divide can widen the achievement gap between students from different socioeconomic backgrounds (Aotearoa, 2022; A. R. Golden et al., 2023; Lythreatis et al., 2022).

These findings suggest the need for targeted interventions that address these disparities. To mitigate the impact of the digital divide, there is a need to consider strategies such as providing equitable access to devices and reliable internet, providing digital literacy programmes, and supporting teachers in using ICT in ways that are inclusive and accessible to all students. In addition, there is a need to provide ongoing support and training for both students and teachers that can enable students, regardless of their socioeconomic background, to benefit from ICT-enhanced Learning Environments (A. R. Golden et al., 2023; Lythreatis et al., 2022). Addressing the digital divide involves more than providing hardware, software and connectivity (Adhikari et al., 2017), it necessitates an understanding of and response to the different learning needs of students to effectively utilise ICT (Acilar & Sæbø, 2023; A. R. Golden et al., 2023; Van De Werfhorst et al., 2022; Zhao, 2024). The findings of this study suggest that without intentional efforts to bridge the digital divide, the increasing use of ICT may unintentionally exacerbate existing inequalities, thereby diminishing the benefits.

The findings also highlighted concerns about the impact of ICT on social connections. While ICT greatly enables communication, it also leads to a reduction in face-to-face interactions, which is essential for developing social and emotional skills (Contrino et al., 2024; Gómez-Rios et al., 2023; Slovák & Fitzpatrick, 2015; Walker & Venker Weidenbenner, 2019). Principals expressed worry that excessive reliance on ICT might erode interpersonal relationships within the school community, both among students and between students and teachers. This concern may reflect societal anxieties about the impact of digital technology on human relationships, because the overuse of digital devices could lead to a significant decline in social skills and increased feelings of isolation (Falzon, 2019; Livingstone et al., 2023; Turkle, 2016, 2023).

Health implications related to the overuse of ICT were also noted, including issues like eye strain, poor posture, and reduced physical activity, which could negatively impact students' overall well-being (Scherer & Hatlevik, 2017). The above-mentioned factors highlight the need to encourage the use of ICT in moderation and in ways that support, rather than detract from, students' physical and mental health. This is important because there is a substantial body of research indicating that prolonged screen time is associated with a range of negative health outcomes, including sleep disturbances and increased risk of obesity (Çavuş, 2023; Kerai et al., 2022; Pandya & Lodha, 2021).

To summarise, the previous sections have considered the way that ICT can be a transformative pedagogical tool. While teachers and students need to manage issues associated with ICT use to maximise learning opportunities, this study has found that the use of ICT in the classroom can have a significant impact on student learning experiences.

5.3.4 The Role and Impact of ICT: Teachers Are on a Journey with ICT

The data from this study indicates that while there is widespread recognition of the benefits of ICT, there is also a degree of scepticism among some teachers. Principals reported that a minority of teachers initially resisted the integration of digital technology into their teaching practices, expressing frustration about the often-observed loss of personal interaction with students. Some also questioned the effectiveness of ICT as a teaching tool. This resistance is in line with findings from other research, which identify similar concerns among educators in three specific contexts. The first is fear that ICT may diminish the quality of student-teacher interactions, and the second is that ICT may lead to a more impersonal learning experience (Howard, 2013; Howard & Mozejko, 2015; Masry-Herzalah & Dor-Haim, 2022; Peng et al., 2023). Thirdly, resistance to ICT is often reflective of teachers' lack of ICT capacity (Newhouse, 2008b). According to Newhouse (2008), teachers who are not proficient with ICT may feel anxious about incorporating it into their teaching, fearing that technical difficulties or their own limited skills may hinder learning.

However, both principals and teachers shared how attitudes have changed over time and emphasised the role of targeted professional development and peer-led training sessions in facilitating this shift. For instance, teachers described a series of workshops that introduced

the faculty to the pedagogical benefits of ICT, describing successful case studies from within and outside the NZ SDA school system. These sessions addressed misconceptions about digital technology use and inspired educators to more confidently use new ICT based resources and pedagogical methods that utilise ICT.

The transformation observed in teachers' attitudes towards ICT may be attributed to the impact of professional development. This agrees with the major findings of the Quality Teaching Rounds project, where there is over a decade of results showing that in many schools, professional development has changed teachers' mindsets, and they become more effective in their practice (Gore et al., 2023; Gore, 2021; Patfield & Gore, 2023; Patfield et al., 2022). This shift in mindset among educators draws attention to the role that professional development can play in facilitating change within Learning Environments (Bowman et al., 2022; Davies & Willing, 2023; Zdanevych et al., 2024).

Research on ICT integration within Learning Environments indicates that professional development programmes on collaboration and practical application can significantly alter teachers' attitudes (Guggemos & Seufert, 2021; Ottenbreit-Leftwich et al., 2023; Yurtseven Avci et al., 2020). This is particularly important because ICT is becoming increasingly integral to pedagogical practice because, in many learning environments, it is the only way to access learning material (OECD, 2022b, 2023e).

Teachers' insights regarding creating a supportive environment for ICT experimentation highlight the importance of professional development. This professional development has been found to change attitudes towards technology and develop the skills to practically apply the learning. These findings highlight the importance of building and nurturing innovation in schools. When this occurs, the result is that teachers feel encouraged and supported to experiment with new technologies, which has also been found by other scholars (see Dong et al., 2020; Kafyulilo et al., 2015; Kwangmuang et al., 2021b; Sotiriou et al., 2016). Such an environment is important in encouraging a positive attitude towards ICT and mitigating the natural risk-aversion of teachers (Ayaita & Stürmer, 2020; Howard, 2013; Howard & Mozejko, 2015).

The role of school principals also emerged as a significant theme in the teachers' interviews, highlighting the considerable influence of leadership in driving this digital transformation. This emphasis on the value of school leaders is well-established (Fios et al., 2024; Sliwka et al., 2024), and effective leadership is fundamental to the successful integration of technology into schools (Bektaş et al., 2022; Karakose et al., 2021; Striepe et al., 2023; Ugur & Koç, 2019). Furthermore, such a leadership role corresponds directly with the principles of the NISS Framework (Newhouse, 2008b), suggesting that successful ICT integration requires infrastructure and effective leadership. This, in turn, is in agreement with research that states, "To date, we have not found a single case of a school improving its student achievement record in the absence of talented leadership." (Louis et al., 2010, p. 9).

5.3.5 Summary

In this study the participants perceived that the role and impact of ICT in supporting the Learning Environment is significant. The use of ICT is seen to extend learning possibilities, enable collaborative and project-based work, enable customising of learning experiences and effectively promote active learning. Further, the integration of ICT within the NZ SDA school Learning Environment is seen by the participants to enable students to take greater control of their learning and to engage actively. These attributes parallel very closely a number of those identified by Newhouse (2008b), when ICT is used effectively in the Learning Environment.

It was the teachers and principals, as expected, that link the use of ICT with more effective and timely assessment and content management. It was also the teachers and principals, however, that were silent on the role ICT could play in developing Newhouse's (2008b) attribute of High-Level Thinking. Finally, the data indicated that the participants saw that the two biggest ICT challenges at the class-room level for enhancing the Learning Environment are digital distraction and the digital divide, which are also identified in other studies (Cheshmehzangi et al. 2023; Flanigan et al. 2023; Harvey et al. 2023).

5.4 Research Question 3. What Needs to Be Established at the System, School, and Classroom Levels to Enhance the Learning Environment in NZ SDA Schools; with a particular emphasis on the role of ICT?

5.4.1 Introduction

This section addresses the final research question. It discusses the potential enhancements to the Learning Environment that were identified by the students, teachers, and principals. After considering the common perspectives of the participants, the discussion moves to consider enhancements across the three interconnected tiers: the system, school, and classroom levels. It starts from a macro perspective, focusing on the system level, where the educational policies and frameworks are set. It then transitions to concentrate on factors identified at the school-level. Finally, the discussion focuses on the classroom-level, often described as the 'frontline' where direct interactions between teachers and students take place (OECD, 2021g, 2023b).

Recognising the sometimes-blurred boundaries between these levels is important as each level's developments have a cascading effect on the others. While acknowledging overlaps and interdependencies, this layered perspective provides a structured method for making suggestions. By discussing these three interconnected tiers separately, this study aims to provide recommendations that are broken down into different tiers. This is considered best practice because it breaks down recommendations into what is more actionable (Cameron & Green, 2019).

5.4.2 Enhancement of the Learning Environment: Comparisons

From the students' viewpoint, ICT plays a significant role in shaping their learning experiences. The data reveals that while students appreciate and value the current use of ICT, they desire specific enhancements to the Learning Environment to improve their engagement and learning outcomes. Students expressed a strong interest in more interactive and collaborative learning activities that incorporate ICT. For example, student 3, 5 and 7 indicated that they would benefit from the incorporation of educational games that they said

would make learning more engaging. For example, student 7 said, “It would be awesome if they made it more fun, the maths games are cool, and we learn heaps…”

Students repeatedly highlighted the need for more personalised learning experiences. They suggested that ICT could be used to tailor educational content to their individual learning styles and pace. Student 8 said, “It would be great if we could have it at our own speed, so we get it before moving on to the next stuff.” This desire for adaptive learning technologies is well established with research indicating that personalised learning can enhance student engagement and achievement (Mishra et al., 2021; OECD, 2023b).

Students also expressed a desire for improved access to ICT. In all the schools, students reported difficulties in accessing school-provided devices and on occasion, a reliable internet connection. This hindered their ability to effectively participate within the learning environment. For example, according to student 10, “Sometimes the WIFI is not working, or the Chromebook is not working and there are no spares …” This suggests that there is a need for more investment in ICT infrastructure and a need to address digital equity.

In addition, students spoke about the impact of digital distraction and fatigue. They expressed concerns about the impact of excessive screen time on their ability to maintain sustained attention and focus. These findings agree with the large amount of literature on the harmful effects of prolonged screen time. For example, Gregersen et al. (2023) and Marougkas et al. (2024) found that excessive screen time can lead to reduced attention spans and digital burnout, which reduces students’ academic performance. This sheds light on a growing awareness of the need for balanced implementation of strategies that prioritise academic achievement and student well-being. The implication is that ICT can be like a double-edged sword in that it requires careful monitoring as unfettered access to ICT can result in adverse learning outcomes.

Teachers provided a different yet complementary viewpoint. They specifically spoke about the importance of evidence-based and pedagogically driven ICT integration. Their insights highlight the role teachers play in incorporating ICT with traditional teaching methods, to ensure that ICT enhances the Learning Environment. For example, according to Teacher 4, “ICT has the ability to support different learning styles, but it should be used in a way that

complements what we know is effective ....". This perspective has been referred to as 'an entangled pedagogy' (Fawns, 2022b), which goes hand-in-hand with the need for ICT to be used with sound pedagogical principles to be effective (Aparicio et al., 2021; Wells & O'Riordan, 2021). Instead of viewing ICT in isolation, to be effective it needs to be incorporated as a tool that complements other teaching approaches to positively transform the Learning Environment.

The 'entangled pedagogy' approach suggests that the use of ICT should be driven by the students' learning needs rather than the technology itself (Fawns, 2022b). Teachers suggested enhancements such as integrating collaborative online software such as shared Google and Microsoft documents, presentations and spreadsheets to facilitate group projects. They also spoke about the benefits of more frequent use of interactive software such as Kahoot to provide immediate feedback. They also spoke about using Learning Management Systems that they already have such as Google Classroom to tailor instruction based on individual student progress. Teachers said that by intertwining ICT with effective teaching strategies, they can create Learning Environments that better meet the needs of their students.

Teachers also highlighted the necessity of more and ongoing professional development to improve their ability to maximise the potential of ICT. Teachers from all three schools felt that they did not know enough about utilising ICT effectively, which they found frustrating. The teachers' viewpoints are reflective of common challenges in schools, whereby teachers need to be supported to adapt to changes (Gore et al., 2023; Mahat et al., 2024; Mishra et al., 2024). This finding is supported by the Quality Teaching Model and TPACK, which highlight the importance of continuous professional development in equipping teachers with the skills necessary to use ICT effectively to support different learning needs (Gore et al., 2023; Mahat et al., 2024; Mishra et al., 2024).

This finding also suggests the need for continuous investment in teacher professional development to provide teachers with the knowledge and confidence to use ICT within the Learning Environment. Research indicates that there is a correlation between effective ICT use in Learning Environments with the quality of teacher's professional development (Kong & Wang, 2024; Sok & Heng, 2024). Hence, without ongoing targeted professional

development, there is a greater probability that ICT will not be utilised to its full potential within the Learning Environment, resulting in missed opportunities.

Principals provided a distinct perspective, focusing on the managerial aspects of ICT within the school. They raised two major points. The first was the need to use ICT in a way that is in harmony with the core values of Adventist Education. They mentioned that while there already is an increasing incorporation of ICT into the Learning Environment, they emphasised that this must be done in a way that ensures ICT complements, rather than detracts, from the SDA education philosophy of holistic education. The principals were challenged to balance innovation with preserving the school's Special Character. They remain focused on integrating ICT into the Learning Environment in ways that maximise academic outcomes, however, at times, principals perceive ICT use as conflicting with the core values of Adventist Education due to some of the negative aspects associated with ICT use.

The second concern that Principals spoke at length about was about the problems associated with budgeting for ICT investments. Financial constraints are a significant barrier to having a fit-for-purpose ICT infrastructure, a theme that has, unsurprisingly, been found by other researchers (Lomos et al., 2023b; MOE, 2021b). These findings have implications for SDA schools. These implications are that NZ SDA schools need strategic plans to ensure that the allocation of resources is both sufficient and sustainable. This can allow for updates to ICT infrastructure and professional development for teachers. Without a clear roadmap, SDA schools risk falling behind in providing students with a modern, quality Learning Environment. Balancing ICT investment with other educational priorities requires a collaborative effort from school leadership, staff, and the school community. Such collaboration can result in additional funding which can resolve financial pressures (Fernández-Gutiérrez et al., 2020; Lomos et al., 2023a; Newhouse, 2012). In short, principals want ICT to be used in a way that supports the Special Character of schools, and they want sufficient funding so that their efforts are successful.

The cumulative insights from students, teachers, and principals illustrate the complex relationship between ICT and pedagogy in NZ SDA schools. The findings highlight the necessity of a balanced strategy for ICT integration, that is, one that improves learning

outcomes, supports a wide range of learners with different needs, is within budgetary constraints and is in harmony with the core values of Adventist Education.

The NISS Framework provides a blueprint for schools aiming to transform their Learning Environments (Newhouse, 2008b). To maximise the occurrence of the Learning Environment attributes, the enabling dimensions identified by the NISS Framework: Students' Characteristics including ICT capacity, Teacher ICT Attributes, School ICT Capacity, and School Environment, have to be considered (Newhouse, 2008b). These enabling dimensions need to be present and functioning (Newhouse, 2008b). Study participants were asked what needs to be enabled and what changes are needed for ICT to transform the Learning environment in NZ SDA schools. They reported that the following changes are needed:

5.4.3 Recommendations at the System-level

The NZ SDA schools make up a school system within the greater New Zealand educational system. Research has reported that system-level changes can improve learning outcomes (OECD, 2023b). One of the reasons for this is that because of the rapid advancements in educational technology, often what is required is leadership from higher-level authorities (Chan & Tsi, 2023; Mishra et al., 2024; Schmid et al., 2022). There have been continual national education reform initiatives, including curriculum overhauls that are currently happening in NZ (McPhail et al., 2023; MOE, 2022c), which stresses the value of this system-level consideration. In addition, the changing nature of skills required in the workplace (Varas et al., 2023; Williamson, 2024), and its influence on teaching methodologies and the refreshing of curriculums (OECD, 2023b), accentuates the need for system-level evaluations. In this section, we discuss the viewpoints of the stakeholders: students, teachers, and principals on what they recommend at the system-level.

5.4.3.1 The Need for a Curriculum Refresh

This study found a growing preference among students, teachers, and principals for a curriculum that is academically stimulating and reflects their personal interests and real-world experiences. This trend is a significant shift from the traditional view of students as

passive recipients of knowledge to active participants (Davis, 2023; Dello-Lacovo, 2009; Dilekçi & Karatay, 2023; García-Almeida & Cabrera-Nuez, 2020; Taub et al., 2020). It is well established that this generation of learners work best in a Learning Environment where they are active participants (Børte et al., 2023; Owens et al., 2020), and for the Learning Environment to be engaging and responsive to their different learning needs (Shearer et al., 2020; Tomlinson & Jarvis, 2023). This demand extends to the content of what they are learning, and the methods used to teach them being relevant to their life experiences and cultural contexts (Araneda et al., 2019; Napan et al., 2020; Young, 2014).

Central to the students' preferences is the request for a curriculum that balances cognitive accessibility and curricular relevance, which contributes to increasing student motivation and engagement. This perspective matches with research findings on curricular materials that are challenging yet are within the grasp of students' abilities (Bawden & Robinson, 2009; Brinegar & Bishop, 2011; Feroz et al., 2022; Getenet & Tualaulelei, 2023; Gouëdard et al., 2020). The students in this study emphasised the need for a learning process that is efficient and free from perceived time wastage indicating a desire for a more streamlined pedagogy. This preference may be influenced by observations that many students who extensively use ICT tend to have shorter attention spans (Harris, Chen, et al., 2024; Rosengrant et al., 2021; Szymkowiak et al., 2021). The students' focus on efficiency fits with teachers' and principals' objectives to have high levels of student engagement.

The students also called for a curriculum that accommodates their learning styles, a concept well-supported in the scholarly literature on the accommodation of different learning styles, engagement, and inclusivity in Learning Environments (Hileman, 2009; Hiver et al., 2024; Tomlinson & Imbeau, 2023; Uleanya, 2023). The integration of current and relevant topics into the curriculum reflects students' desire for an education that is academically relevant and attuned to contemporary societal issues and trends that they find relevant. This is in agreement with recent research that highlights the importance of real-world applicability in pedagogy that students find engaging (Archer et al., 2021; Bates, 2023; Morley & Jamil, 2021).

Adding to the discussion on curriculum relevance is the students' and teachers' desire for a culturally responsive pedagogy. This strategy is endorsed by the NZ Ministry of Education

(Glassey et al., 2023; Hargraves, 2022; Lourie & Rata, 2012) and seeks to integrate the different cultural backgrounds, worldviews, and social contexts of students into the lessons (MOE, 2016). It recognises the influence of culture on students' learning experiences, and calls for the establishment of a curriculum that is academically sound, culturally sensitive, and relevant (Nelson & Rehu, 2021; Rajagopal, 2022). This cultural responsiveness, especially within NZ, is an important factor in working effectively with cultural diversity, and mitigating the marginalisation of students from chronically low-achieving backgrounds (Bishop et al., 2009; Hargraves, 2022; Lemon et al., 2023; Mayeda et al., 2022).

Culturally responsive teaching practices involve more than recognising cultural differences (MOE, 2016). It also encompasses actively incorporating these differences into the curriculum and teaching methods (Cruz et al., 2020; McKoy & Lind, 2022). This has been shown to reduce achievement gaps among different cultural groups and improve academic performance (Mayeda et al., 2022; Nelson & Rehu, 2021). This emphasis on tailoring education to meet the different needs and backgrounds of students could be important in addressing another significant challenge experienced by NZ schools. In NZ, school attendance is a significant issue. The latest data from Term 4 of 2023 shows that only 53.6% of students attended school regularly which is defined as attending school more than 90% of the time, which is a small improvement of 3.5% from the previous year (MOE, 2024b). Despite successive government initiatives aimed at increasing school attendance, such as free school lunches (McKelvie-Sebileau & Railton, 2024) and free transportation (Beehive, 2023), school attendance is still poor. The major reason cited for the ongoing attendance issues is the lack of curriculum relevance. According to a report by the New Zealand Education Review Office, students want a curriculum that is more engaging and directly applicable to their lives:

> *"Learners told us they want a more engaging and relevant school curriculum …" (ERO, 2022, p. 113).*

This study supports the findings of the Education Review Office (ERO, 2022) and draws attention to the significant impact that increased curriculum relevance could have on improving academic outcomes in NZ. Addressing this gap could lead to a substantial improvement in student engagement and attendance, thereby enhancing the effectiveness of the educational system.

The students, teachers, and principals want a curriculum that is manageable, culturally inclusive, and relevant to their lives, signalling a shift towards a more student-centred and inclusive educational model. This strategy requires a curriculum that contributes to creating a Learning Environment that is engaging, enabling, and respectful of students' cultural and individual identities. By utilising a needs-based strategy for curriculum development, the education system can cater to the needs and wants of an increasingly varied student body, encouraging academic competencies, belonging, and ownership of their own learning. This can result in more equitable and effective learning experiences, thereby resulting in higher achievement rates.

5.4.3.2 There Is a Need to Increase Funding

On average, New Zealand's investment in education ranks amongst the lowest of all the OECD countries. NZ spends NZ$13,400 per primary student and NZ$16,500 per secondary student. This is in contrast to the OECD averages of NZ$17,550 for primary and NZ$20,160 for secondary students (Gerritsen, 2022). While increased funding is typically considered at the school-level, the SDA school system operates as a system rather than as independent school entities (Education, 2020), making funding of SDA schools more of a system wide funding issue than a school-specific one. This is particularly relevant as SDA schools in NZ are Integrated Schools (MOE, 1993), meaning they are not totally State funded. This means that they receive less financial support per student compared to State schools (RNZ, 2020b).

The data from this study shows that students, teachers, and principals agree that a lack of resources significantly impacts the Learning Environment. Students and teachers highlighted factors, such as inadequate access to necessary digital devices, and poor connectivity in certain areas of the school due to underinvestment in ICT infrastructure. In addition, students in interviews mentioned that their previous schools which were non-SDA schools had far more digital technology than their current school. Furthermore, teachers in all the surveyed schools voiced frustrations with the reliability of existing technology, which, at times, hampers their ability to deliver engaging and effective instruction. They emphasised that these obstacles are not merely temporary logistical problems, such as students forgetting to bring devices; rather, they are ongoing resourcing issues that negatively affect the Learning

Environment. This points to the need for increased support and greater investment in ICT within schools to ensure that the benefits are realised.

Principals also elaborated on the economic challenges these schools face in resource allocation. Operating under limited budgets, they often face the dilemma of spreading funds too thinly, which can hinder the ability to make significant capital investments. These financial difficulties, they pointed out, are deeply rooted in the system and are not easily overcome due to the schools' legally restricted ability to generate income (Clark et al., 2017). The principals mentioned that such fiscal constraints affect certain major aspects of the Learning Environment. This includes the ICT capacity and general infrastructure, as well as the ability to provide extracurricular activities and specialised education programmes.

The need for adequate funding has been extensively researched. Unsurprisingly, scholars have found that access to sufficient financial resources is essential for schools to meet their pedagogical goals effectively (Fredman, 2021; Murray, 2016; Radio New Zealand, 2020; Tyner, 2020). In particular, the NISS framework, as illustrated in Figure 5.2, emphasises that a school's ICT capacity is an important enabling factor (Newhouse, 2008b). The framework suggests that well-equipped ICT infrastructure is an 'enabling dimension', in other words, a foundational factor in providing an effective Learning Environment (Newhouse, 2008b). Recent studies emphasise the importance of such infrastructure, which requires significant capital investment for their initial setup and substantial ongoing maintenance expenses (Gil-Flores et al., 2017; Machusky & Herbert-Berger, 2022). Morris and Imms (2023a), OECD (2023d), and Surry and Baker III (2016) also confirm that this infrastructure is capital-intensive and incurs substantial maintenance costs, which schools are often unable to afford. In fact, the OECD (2023d) is so concerned about the state of ICT infrastructure that a recent report was titled, "Is Education losing the race with technology?"

Therefore, the effective integration of ICT into Learning Environments involves the requirement of sustaining an infrastructure that is capable of supporting these technologies effectively over time (Barrett et al., 2019; McNichol, 2016). This requirement draws attention to the role a well-planned and adequately funded infrastructure has in creating Learning Environments that is fit for purpose (Groff, 2013; Morris & Imms, 2023a). The ability to continuously update and maintain technology infrastructure supports pedagogical

advancements so that schools remain relevant given the rapid obsolescence of technology (Fisher, 2021a; Vergara et al., 2020). On the flip side, cost-effective solutions can be found. For example, Kalogiannakis et al. (2021), and Kalelioglu and Sentance (2020), have shown that innovative ways to use more affordable or existing technologies can partially mitigate the lack of extensive funding. They argue that with proper systematic planning and strategic implementation, schools can utilise limited resources to still bring about meaningful educational improvements.

Adequate levels of investment are indispensable in establishing sustainable innovative Learning Environments (Escueta et al., 2020; Fisher, 2021b; Imms et al., 2017; Morris et al., 2023; Tyner, 2020). They contend that while ingenuity and resourcefulness are important, there are limitations to what can be achieved without adequate funding (Imms & Mahat, 2022). This perspective is important, especially in the context of a well-planned innovative Learning Environment, which requires the technology itself, the associated infrastructure (Imms, 2018; Siswanto et al., 2021), and professional development for teachers (Fernández-Batanero et al., 2022c; Gore et al., 2023; Guggemos & Seufert, 2021).

The financial constraints experienced by NZ SDA schools as outlined by the principals significantly impede their ability to meet the objectives of the NISS framework (Newhouse, 2008b), especially concerning the enhancement of schools' ICT capabilities. These fiscal limitations act as barriers to the realisation of the framework's goals. Consequently, it becomes imperative for these schools to either devise innovative and sustainable strategies in finance and resource management or to secure increased funding. Formulating and implementing viable solutions to these challenges is more complicated in the current economic context because NZ is officially in a technical recession (RNZ, 2024). This economic climate adds additional layers of difficulties to securing additional finance. Therefore, exploring effective strategies for overcoming these financial challenges in the context of educational technology integration, especially during economic downturns, is a useful direction for future research.

To summarise, the interviews with principals found that financial challenges in NZ SDA schools significantly influence the state of their Learning Environments due to the impact on the schools' ICT capacity (Newhouse, 2008b). Both students and teachers reported being

hampered by inadequate ICT resources, supporting the principals' observations. These financial constraints are a significant barrier to maximising the benefits of ICT. Developing sustainable financial models and creative funding solutions is essential in having a Learning Environment that is fit for purpose.

5.4.4 Recommendations at the School-level

Having discussed recommendations at the system-level, our attention shifts to the school-level.

5.4.4.1 ICT Integration: The Need for Access to Devices

A major concern identified in this study at the school-level is the need to have access to devices. This concern is particularly acute in many NZ SDA schools, which cater to students from lower socioeconomic backgrounds (MOE, 2024a). Principals highlighted their strong commitment to enabling all students, irrespective of their socio-economic status, to have the necessary technology for effective learning. Principals commented that they are well aware that bridging the digital divide is essential in preventing the exacerbation of existing inequalities, which is a concern that is widely acknowledged in the literature (Aotearoa, 2022; Celik, 2023a; Mathrani et al., 2022; Zhao, 2024).

In addition to the principals' viewpoints, teachers emphasised that insufficient access to devices complicates their teaching practices, directly impacting how they deliver the curriculum, and this subsequently results in reduced student engagement. For example, Teacher 7 said, "When not all students have devices, it mucks up lessons." This observation corroborates findings indicating that inadequate ICT resources can significantly hinder effective pedagogical practice (Aotearoa, 2022; Cheshmehzangi et al., 2023). For example, according to a report by the NZ Education Review Office (ERO, 2022), approximately a quarter of students who do not attend school regularly cite the lack of requisite digital devices as a major reason for their disengagement. This situation is particularly grave given the increasing reliance on ICT for learning, especially in hybrid or online educational models that have become more prevalent since the COVID-19 pandemic (OECD, 2022a).

Students also reported significant frustrations due to variable access to technology. This lack of access interrupts their day-to-day learning experiences and reduces their motivation. Such frustrations are not isolated; numerous studies have highlighted the importance of access to technology for student success in digital Learning Environments (Afzal et al., 2023; Gonzales, 2016; Lythreatis et al., 2022). Failure to address these barriers can lead to increased student failure rates that affect individual learners and can have damaging repercussions for society as a whole (Gottschalk & Weise, 2023). These specifically include widened educational inequalities and reduced economic productivity (Ma, 2021; Van Dijk, 2017).

As previously mentioned, an important enabling dimension of the NISS Framework, is the school's ICT Capacity, which includes access to infrastructure and devices (Newhouse, 2008b). The framework outlines that without sufficient ICT capacity, schools cannot realise the full potential of ICT-enhanced Learning Environments, hence the importance of adequate financial investment in ICT capacity.

To resolve device accessibility problems, principals identified that schools require investment in ICT, and also teacher training and support. These strategies have been identified in the literature (Gore et al., 2023) as requirements to ensure the effective integration of ICT into pedagogy (Viberg et al., 2020). It supports a need for innovative solutions to financial challenges that can impede equitable access to technology (Liao et al., 2022), such as seeking external support or exploring cost-effective educational technologies (RNZ, 2020a).

The use of a hybrid model, combining BYOD policies with school-provided devices, helps alleviate the financial burden on the schools (Adhikari et al., 2017, 2021; Rae et al., 2017). This strategy allows students who own personal devices to bring them to school while providing school-owned devices to those who do not (Santos, 2020). However, principals in this study observed that while this helps mitigate immediate financial constraints, it also introduces limitations. Principals reported that devices purchased by the school typically remain within the classroom to prevent loss or damage, which was a significant issue when students were previously allowed to take devices home. This policy, while protecting school assets, unfortunately, limits students' ability to benefit from this technology at home.

The implications of this restriction are significant because limiting device use on school premises hinders the continuity of learning outside the classroom, thereby exacerbating inequalities. Students who do not have access to personal devices at home are disadvantaged, as they are unable to complete homework, engage in self-directed learning, or access digital resources after school hours. This restriction impacts students' academic performance and influences their digital literacy and readiness for an increasingly digitised future.

These challenges highlight the need for schools to implement additional strategies to support equitable ICT access during and after school. One strategy is implementing a lending programme where students can borrow school devices for home use under strict guidelines and with proper tracking mechanisms to reduce the risk of loss or damage. Schools can collaborate with community organisations or seek external funding to provide affordable devices and internet access to students in need. This could result in all students having access to ICT both within school and at home.

To summarise, the discussions with students, teachers, and principals identified that access to devices is a significant issue. While progress has been made in ensuring device accessibility within school environments, a digital divide persists. This ongoing issue necessitates further research and innovative solutions to bridge the gap so that there is equitable access. Solving this digital divide is essential for improving educational equity and enabling all students to benefit from the transformative potential of ICT (Adhikari et al., 2017; Cheshmehzangi et al., 2023; A. R. Golden et al., 2023). As schools continue to try to solve these challenges, it is necessary to take stock of what is working and what is not. Research indicates effective strategies include access to devices and support systems for teachers and students (Kumi-Yeboah et al., 2023).

5.4.4.2 The Need to Implement Hybrid Learning Systems

A major recommendation from this study is for schools to implement hybrid learning systems where learning is decentralised from the school. All research participant groups spoke about the substantial benefits of effectively integrating such systems. Principals highlighted staffing limitations that could be mitigated by adopting a hybrid methodology. This would

allow schools to offer remote lessons in specialist subjects by using resources and expertise from other institutions within the NZ SDA education system.

The NISS Framework outlines how the school environment is an important factor in the effective integration of ICT (Newhouse, 2008b). A supportive school environment is one of the important enabling dimensions in the implementation of Hybrid Learning Systems. Hybrid learning requires schools to invest in an environment that encourages innovation and provides necessary resources (Raes et al., 2020; Raju & Roy, 2022).

The positive feedback from students about their COVID-19 pandemic-era remote learning experiences indicates an acceptance and readiness for hybrid models. Students appreciated how online lessons were individualised to meet different learning preferences and needs. This was seen to extend educational opportunities beyond the confines of traditional classrooms into more flexible virtual environments. This adaptability was important in catering to individual learning styles and for ensuring educational continuity during disruptions (Cook & Holley, 2022; Gulliksen et al., 2023; Harris, Chen, et al., 2024).

Despite the advantages, implementing hybrid learning systems is complex. One of the major challenges identified by principals in this study is the increasing disparity that exists between students. As mentioned in the previous section, these disparities, especially around access to devices, and internet connectivity at home, can cause educational inequalities (Afzal et al., 2023). This was a concern that principals highlighted and has also been identified in scholarly research (Cheshmehzangi et al., 2022; Krishnaswami et al., 2022). A barrier exists in the resistance of some teachers to change their traditional teaching methods. To mitigate such resistance, professional development and training is essential for both teachers and students to develop the digital competencies necessary to maximise the benefits of hybrid environments (Ahadi et al., 2024; Gore et al., 2023; Nørgård, 2021; Thurm et al., 2024).

While integrating hybrid learning systems provides significant opportunities to increase educational engagement and outcomes (Gulliksen et al., 2023), it also has implementation challenges (MOE, 2022b; Nørgård, 2021). As confirmed by students, teachers, and principals, hybrid systems have the potential to transform pedagogy. However, this transformation requires schools to continue to invest in ICT infrastructure and to provide

professional development to teachers, so that challenges can be overcome and the benefits of hybrid learning realised.

5.4.4.3 Schools Need Strategies to Deal with False Information

The rise of false information has been identified as a global concern, especially during the COVID-19 pandemic (Soetekouw & Angelopoulos, 2024). This study has found that it also has the potential to impact the Learning Environments in NZ SDA schools. The emergence of "fake news", which is the propagation of false information, has ushered us into a "post-truth era" (Compton et al., 2021). This is a significant concern because research indicates that students struggle to discern factual content from misleading information (Parker, 2023; Soetekouw & Angelopoulos, 2024).

Teachers in this study reported that students are often unable to distinguish between true and false information. They expressed concern over students' difficulties in critically evaluating the validity of information. They mentioned instances that students frequently accepted dubious sources as reliable. Students themselves reported feelings of being overwhelmed by the large amount of information available online, making it difficult to identify trustworthy sources. Principals, in addition to the worry about false information, also spoke at length about cyber safety, and the exposure of students to inappropriate content, which introduces an added layer of concern around online content.

The NISS framework (Newhouse, 2008b) emphasises the importance of teacher attributes, particularly their ICT capacity, as an enabling dimension in creating effective Learning Environments. According to the framework, teachers need technical skills and pedagogical understanding to integrate ICT in ways that enhance critical thinking. By developing strong ICT capabilities, teachers are in a better position to utilise the potential of ICT as a transformative pedagogical tool. Increasing teachers' ICT capacity is important if one wants to equip students with the skills necessary to effectively deal with online dangers such as harmful and illegal content, including the proliferation of false information.

Recognising the urgency of this issue, proposals have been made to update the New Zealand Curriculum to include learning on identifying misinformation, conspiracy theories, and

disinformation (Cook, 2023; Ketchell, 2024; McPhail et al., 2023). The aim is to equip students with the necessary critical thinking skills to effectively evaluate the information they encounter daily (Ketchell, 2024). Finland provides a good model where information literacy is embedded across all educational levels (Berki et al., 2017; Federick, 2020). Acknowledged as the European nation most resistant to fake news, Finland integrates evaluation skills throughout its school system (Sahlberg, 2021). Schools specifically focus on enabling students to be critical from an early age (Cook, 2023; Vartiainen et al., 2023). Given the population and economic similarities between Finland and New Zealand (Worlddata, 2024), New Zealand could benefit from adopting Finland's strategy.

Both the Quality Teaching Model and the NISS Framework emphasise the development of critical thinking and evaluation skills (Newhouse, 2008b; Patfield & Gore, 2023). Developing these skills helps protect against misinformation (Osborne & Pimentel, 2022). Research indicates that students who have good critical thinking abilities are better equipped to scrutinise information critically, and are, consequently, less susceptible to accepting false information as credible information (Haber, 2020; Machete & Turpin, 2020). This highlights the importance of embedding these critical thinking skills within the curriculum and purposefully teaching these skills, so students are equipped to be safer online. Research indicates that students who have good critical thinking abilities are better equipped to scrutinise information critically, and are, consequently, less susceptible to accepting false information as credible information (Haber, 2020; Machete & Turpin, 2020). This highlights the importance of embedding these critical thinking skills within the curriculum and purposefully teaching these skills, so students are equipped to be safer online.

5.4.4.4 There Is a Need for Teacher Professional Development

Discussions with students, teachers, and principals highlight a collective desire to maximise the beneficial use of ICT within the Learning Environments of their schools. While the advantages of ICT are widely recognised for enhancing pedagogy (Archambault et al., 2022a; L. Mishra et al., 2020; OECD, 2023e), a recurring theme in scholarly publications is the barriers to actualising or, in other words, delivering these benefits to students (Barton & Dexter, 2020; Imms & Mahat, 2022; Mutohhari et al., 2021).

Academic literature suggests many strategies to achieve this (Ahadi et al., 2024; Gore et al., 2023; Yue et al., 2024). One that has been successful is the Quality Teaching Rounds project, which highlights the importance of continuous professional development (Gore et al., 2023; Harris, Jaremus, et al., 2024). Quality Teaching Rounds have been effective in equipping teachers with the skills needed to effectively implement the Quality Teaching Model in their classrooms. This includes integrating new technologies and adapt their teaching strategies to meet the changing needs of students in Australia (Bowe & Gore, 2016; Harris, Jaremus, et al., 2024; Vaughan et al., 2023). Given that New Zealand and Australia share many governance and curriculum similarities (Newell & Callister, 2008), including that New Zealand and Australian teaching qualifications are equivalent (Hyde, 2023), there is a high likelihood that the application of Quality Teaching Rounds will work in New Zealand.

Lending more support to this is that principals in this study revealed that professional development has been effective in shifting some teachers' attitudes towards ICT-enabled pedagogy. This was achieved by professional development designed to address resistance and scepticism towards digital technologies in the Learning Environment. For instance, Principal 4 discussed how some educators initially doubted the efficacy of digitised resources, fearing they might diminish personal interaction in the classroom. This concern is supported by research that highlight educator resistance as a significant barrier to effective ICT integration and that professional development can help overcome this resistance (Howard, 2013; Howard & Mozejko, 2015; Masry-Herzalah & Dor-Haim, 2022).

Similarly, teachers reported a significant shift in their attitudes toward ICT, a change attributed to targeted professional development and peer-led training. Teacher 12 described workshops that made teachers aware of the pedagogical benefits of ICT. In addition, Teacher 8 recalled how professional development helped address misconceptions and inspired them to experiment and innovate their pedagogy with ICT. These sessions alleviated fears and demonstrated practical ways to integrate technology effectively in classrooms.

Integrating ICT in NZ SDA schools is an ongoing process characterised by initial resistance that has given way to significant changes in attitudes and practices. These changes are being driven by supportive leadership, teachers who are committed to raising student outcomes using holistic strategies that include professional development, and a strategic call for

teachers to work towards effectively utilising digital technology to improve the Learning Environment in NZ SDA schools.

5.4.4.5 Teachers Need to Effectively Mitigate Digital Distraction

Digital distraction has been identified as a significant concern in this study, with students, teachers, and principals acknowledging its disruptive impact on learning. The issue of unchecked digital usage disrupting academic focus is extensively supported by many academic studies (Delaney, 2022; Flanigan & Babchuk, 2022; Hanin, 2021). Principals particularly emphasised the need for increased supervision, not merely to enforce rules, but to create a safer digital environment. This includes implementing content filters to block inappropriate material. However, they also acknowledged that managing harmful and distracting content involves more than just online content blocking. It involves instilling the values of good digital citizenship (Pashby et al., 2020; Prasetiyo et al., 2023). This highlights the need for mandatory lessons that explicitly teach online safety and responsible internet use. Successful implementation of such strategies requires strong commitment and buy-in from both students and staff to be effective (Flanigan & Kim, 2021; Flanigan et al., 2023; Kärki, 2024).

Teachers, on the other hand, have focused on encouraging students to make informed choices online, integrating digital citizenship into their curriculum to equip students with the skills necessary to be safe online. This is important for developing students' abilities to discern and manage their own digital interactions, thus developing self-regulating behaviour when online (Anthonysamy et al., 2020; Wang, J. Salisbury, et al., 2022).

From the students' perspective, there is a deep desire for engaging and interactive learning experiences that minimise the temptation to get off task. Students have expressed a preference for hands-on, collaborative learning activities that they find meaningful and engaging. When learning content is both relevant and engaging, students are less likely to succumb to distractions, as their focus is drawn to the learning task at hand (Flanigan et al., 2023; McCoy, 2020; Rata et al., 2019).

An underlying issue exacerbating digital distraction is the lack of access to personal digital devices and internet connectivity among students from lower socioeconomic backgrounds. This disparity means that for some students, school time might be their only opportunity to access the internet, which they may use to engage in social activities online. Recognising

that students might be using their limited internet access during school hours to engage in social interactions provides a context for understanding and addressing digital distractions. Researchers in Finland indicate that digital distraction can increase existing inequalities, specifically stating that " … digital distraction in the classroom may lead to an unequal contribution of achievements that require complex cognition by people from lower socioeconomic backgrounds." (Kärki, 2024, p. 7). Interestingly, no directly comparable studies have been done in New Zealand. This gap highlights the need for targeted studies to better understand and address the root causes of digital distraction and its implications for educational equity in NZ SDA schools. Such research could provide actionable data and have significant policy implications because the digital divide has been identified as a major impediment to educational, socioeconomic and social development (Acilar & Sæbø, 2023; Adhikari et al., 2017; Kuteesa et al., 2024).

Participants in this study identified that managing digital distraction in NZ SDA schools requires employing a variety of methods, including improving digital citizenship education, improving student engagement through meaningful learning experiences, and addressing the digital divide. By implementing these recommendations with the holistic focus of Adventist Education (Knight, 2016), schools can work towards positively transforming the learning environment.

5.4.5 Recommendations at the Classroom-level

The classroom is, as the saying goes, "… where the rubber meets the road." (Steinberg, 2012, p. 9). This phrase captures the essence of the classroom environment where the direct impact of pedagogy is most tangibly observed and experienced. It is often a chaotic arena (Sarigoz, 2022), where there is a long history of plans, policies and reforms that have often not gone as planned (Acton, 2021; Fullan & Mundial, 1989), that specifically, look at the classroom because this is where the pedagogy can be observed (Davis, 2017; König & Kramer, 2016; Morton et al., 1997; Postholm, 2013). This focus highlights the role the classroom environment plays in bringing educational goals to life (Emmer & Gerwels, 2013; Glackin & King, 2020). The classroom is the focal point where the interaction between teachers, students, and technology occurs, and where the desired Learning Environment Attributes are actualised (Newhouse, 2008b).

5.4.5.1 Use ICT to Improve the Teacher-Student Relationship

When it comes to enhancing the Learning Environment, the findings of this study suggest that students want an open, engaging, and interactive relationship with their teachers. Students from all three schools expressed discontent, feeling that the increasing use of ICT within their Learning Environments, relegated teachers to more of a supervisory role. This, while appreciated by some students, left others, especially those who require additional support, in need of more direct and personalised interaction.

The need for a pedagogy that maximises the advantages of ICT, while maintaining strong teacher-student interactions, is important (Kimmons & Hall, 2016; Olimov, 2020). Students who require additional support, such as those with learning disabilities or those struggling with certain subjects, are particularly vulnerable in this scenario (Atanga et al., 2020; Svensson et al., 2021). They often benefit the most from individualised attention and instructional methods, which can be challenging especially for inexperienced teachers (Funk & Woodroffe, 2024; Kennedy & Deshler, 2010).

The role of teacher-student relationships in influencing learning outcomes is well-established (Longobardi et al., 2021; Visible Learning, 2023; Wink et al., 2021). As ICT use becomes more prevalent in classrooms, integrating digital technology without diminishing the teacher's role has become an area of increasing academic interest (Ausat et al., 2023; Gros & López, 2016; Wohlfart & Wagner, 2023). Research suggests that effective pedagogical practices should extend beyond ICT use to include the preservation of effective traditional pedagogy, which is fundamental for both cognitive and social development (Allen et al., 2021; Mishra et al., 2024; Wanders et al., 2020; Warr et al., 2019). For students who struggle with self-directed learning, or have specific learning needs, the presence and guidance of a teacher is important (Gore et al., 2023; Visible Learning, 2023; Yan, 2023). These students often benefit from one-on-one interactions (Saclarides & Lubienski, 2021). In addition teachers can provide individualised support, clear instructions, and direct feedback (Nieminen & Carless, 2023; Zhang, 2022). Such personalisation can enable all students, regardless of their learning style or pace, are given the best chance to thrive in an ICT-enhanced Learning Environment (Contrino et al., 2024; Shemshack & Spector, 2020).

The extended school shutdowns during the COVID-19 pandemic highlighted this need. It became evident that students particularly missed the face-to-face interactions with their teachers (Adedoyin & Soykan, 2023; Guppy et al., 2022; Roque-Hernández et al., 2023). This period highlighted the gap that technology is not able to fill, and clearly illustrated the important role of personal interaction in the learning process (Oribjonovich, 2022; Son et al., 2020). Teachers' direct involvement is a significant element in nurturing an effective Learning Environment (Woods & Copur-Gencturk, 2024). This understanding is necessary in designing learning environments that balance increasing digitisation with human elements (Adedoyin & Soykan, 2023; Cheshmehzangi et al., 2022; Pandya & Lodha, 2021).

Interactive teacher-student relationships in enhancing Learning Environments, including environments that incorporate ICT, is well-established (Ng, Leung, Chu, et al., 2023; Williams et al., 2023). This significance is emphasised across educational frameworks, including the Quality Teaching Model, which emphasises the importance of a quality Learning Environment, and significance in teaching practices (Gore et al., 2023). Hattie's Visible Learning (2023) expands this by identifying teacher-student relationships as a significant factor in student achievement. In addition, it is necessary for teachers to appreciate and respond to individual student needs, and to make the learning process engaging and transparent (Visible Learning, 2023). Furthermore, the TPACK model provides a more holistic understanding of how technology can positively transform these interactions (Kong et al., 2023; Soto & Herrera, 2023). According to TPACK, teachers' effective integration of technological knowledge with pedagogical and content expertise may significantly improve the learning experience (Celik, 2023b; Kong et al., 2023; Wekerle & Kollar, 2022).

Effective teacher-student interactions in the classroom encompass certain strategies. The major ones include open-ended questioning techniques that encourage critical thinking (Poitras et al., 2017) by allowing students the freedom of expression and to consider new ideas, thus encouraging the development of being open-minded which is an important 21st-century skill (Asad et al., 2021; Shafie et al., 2019). Collaborative discussions help with shared learning experiences, providing opportunities for peer learning, which has been found to be effective (Lai et al., 2019; Yan, 2023). Furthermore, constructive feedback engages

students in their learning, providing them with insights into their progress, and areas for development (Fong et al., 2021; Gan et al., 2021; Gore et al., 2023).

Teacher responsiveness in influencing learning outcomes is established (Wisniewski et al., 2019). Giving quick feedback (Han & Xu, 2020), combined with empathy (Meyers et al., 2019) and student-centred pedagogy (Xhomara, 2022), significantly increases student engagement and achievement (Gentrup et al., 2020; Wisniewski et al., 2019). This can involve tailoring teaching strategies to meet the individualised learning styles and needs of students, reinforcing the principles of differentiated pedagogy (Johler & Krumsvik, 2022b; Tomlinson & Imbeau, 2023). The incorporation of ICT, as described by the TPACK and NISS frameworks, further supports this adaptability, providing additional ways to interact and learn (Newhouse, 2008b; Ong & Annamalai, 2023; Puentedura, 2010).

Expanding these core principles and combining the ideas in these frameworks provides a holistic view of the classroom as a changing space, where effective teaching practices, student engagement, and technology integration converge to create a Learning Environment. It also calls attention to the fact that education is not merely the transfer of knowledge (Barrouillet, 2015; Piaget, 1964). It is a complex interaction of factors that contribute to the development of the learner (Newhouse, 2008b; Warr et al., 2019). These factors suggest that educators need to be continuously reflective and adaptive in their teaching (Gore et al., 2023), integrating new and existing technology (Imms & Mahat, 2022), in combination with an understanding of the specific needs of students within their Learning Environments (Gupta & Mishra, 2021; Mishra & Mehta, 2017).

5.4.5.2 Teachers Need to Incorporate Engaging Learning Activities

The findings from this study highlight the significant role of engaging activities in improving learning experiences. Feedback from students, teachers, and principals supports the use of ICT-incorporated pedagogy in a way that boosts engagement. These findings agree with research that demonstrates that the strategic use of ICT increases engagement and positively affects student outcomes (Dubey et al., 2023; Hiver et al., 2024; Roque-Hernández et al., 2023). Importantly for this study, recent research in New Zealand has indicated that one of

the reasons why New Zealand has low attendance rates is that schooling is not engaging (ERO, 2022). Therefore, having a way to boost engagement is an important area of interest.

An increase in student engagement can occur when teachers aim to redefine learning experiences using ICT. This is because teachers are encouraged to shift from merely using technology as a direct substitute for traditional teaching methods to a modification and redefinition of the learning experience (Croupe, 2023; Ong & Annamalai, 2023; Puentedura, 2010). Similarly, the NISS framework, as discussed earlier, emphasises the creation of Learning Environments that encourage active learning, deep engagement, and collaborative activities. Newhouse identified 11 Learning Environment Attributes (LEAs) that are the result of such environments (Newhouse, 2008b). Table 5.1 below, adapted from the NISS framework, maps these attributes to the five major student needs identified in this study.

Table 5-1 LEA Attributes from NISS Framework (adapted from Newhouse, 2008b)

Student Needs	LEA Attribute
Engagement and Motivation	Engagement
Self-paced Learning	Learner Independence
Cognitive Development	High-level Thinking, Knowledge-building
Practical Application	Active Learning, Authentic Assessment
Accessibility and Inclusion	Physical Disabilities Equity, Collaboration and Cooperation

Students in this study explained that enhancing their ICT skills allowed them to engage with the learning content. According to the NISS framework, student capability is an important enabling dimension in the effective integration of ICT within Learning Environments (Newhouse, 2008b). Student ICT capability refers to the competencies that students have in using ICT for learning purposes (Newhouse, 2008b). It is well established that by developing ICT capabilities, students can engage more deeply with the learning content (Dubey et al., 2023), collaborate effectively with peers (Fawns, 2022a), and become self-directed learners (Pan, 2020). Enhancing student capability involves purposefully teaching technical skills, critical thinking, problem-solving, and digital literacy skills (Dubey et al., 2023; Marín & Castaneda, 2023).

There is much research supporting the effectiveness of developing these Learning Environment Attributes in boosting student engagement within classrooms (Beamish & McLeod, 2014; Lowell & Tagare, 2023; Newhouse, 2015b; Weng, Chiu, et al., 2022a). The whole-of-school strategy, as outlined in the NISS Framework, provides an evidence-driven basis for educators to positively transform learning experiences (Newhouse, 2008b). By selecting teaching strategies that achieve these attributes, educators can create effective and engaging Learning Environments that are responsive to the varied needs of students.

For some teachers this may require them to re-envision their pedagogy (Mishra et al., 2024; Newhouse, 2008b; Puentedura, 2010; Sackstein et al., 2022). Previous studies have identified that engaging activities in the classroom can take multiple forms that extend learning beyond traditional methods to incorporate digital and interactive components. Activities such as project-based learning (Varas et al., 2023), which involve students in real-world problem-solving tasks (Morley & Jamil, 2021), are improved when coupled with ICT (Newhouse, 2017). Such an integration can deepen students' understanding of academic concepts, develops essential skills, such as critical thinking, creativity, and collaboration, which are essential 21st-century skills that are desperately needed in the workforce (OECD, 2018b, 2021e; Thornhill-Miller et al., 2023). The aim is to move beyond viewing technology as merely a digital substitute for traditional teaching methods (Puentedura, 2010). Instead, educators are encouraged to use technology as a transformative tool that can significantly improve student outcomes.

In the context of Adventist Education, which prioritises active engagement and participation (Knight, 2016), the request by the participants in this study for more engaging activities is logical. A more active and engaging use of ICT can help teachers enable this for students (Archambault et al., 2022b), providing a more collaborative (B. Thornhill-Miller et al., 2023) and interactive Learning Environment (Buehl, 2023). This strategy can also help tailor the pedagogy to individual learning styles and needs (Millen & Gable, 2016; Tomlinson & Imbeau, 2023). For instance, adaptive learning technologies can provide personalised learning pathways, catering to each student's pace and style of learning (Streicher et al., 2019; Taylor et al., 2021; Zourmpakis et al., 2022). This can make learning more engaging and increase the likelihood that students' needs are met within the Learning Environment. By integrating ICT in ways that facilitate positive and interactive teacher-student

relationships, NZ SDA schools could positively transform both the engagement and effectiveness of their Learning Environments. This reaffirms the holistic educational goals of SDA schools (Plaatjes, 2014) and provides the necessary elements for students to be more engaged, thoughtful, and adaptable learners in an online or hybrid Learning Environment.

5.4.5.3 Students Need Help to Combat Information Overload

Cognitive Load Theory (Sweller, 2020) describes how effective learning occurs when the brain's capacity to process information is optimally engaged without being overwhelmed. In the interviews, students spoke about their challenges with managing the sheer volume of information delivered to them, which often resulted in them experiencing cognitive overload. For example, Student 7 said "Sometimes I just don't get it. Like, it's important that we really get it. Overloading us with too many instructions quickly just doesn't help."

Cognitive overload can be mitigated (Bahari, 2023; Daniela, 2021; Nelson & Erlandson, 2008). One way to achieve this is through the use of scaffolding, a strategy recognised for its significant benefits in supporting student learning (Ertmer, 2017; Shvarts & Bakker, 2019). Scaffolding, while not a new educational concept, is often associated with the work of Vygotsky and Bruner in the 1950s (Shvarts & Bakker, 2019). It has been shown in numerous recent studies to be effective when integrated with ICT (Arantes, 2022; Dever et al., 2024; Ertmer, 2017; Kahila et al., 2024). These scaffolding techniques are useful in guiding and supporting students as they work their way through more complex levels of understanding. This has been proven to provide a structured way to tackle cognitive challenges (Doo et al., 2020; Shin et al., 2020).

Students in this study reported that when teachers provided clear, step-by-step instructions and made sure that students understood what they were doing before proceeding, it helped them manage the information and reduced feelings of being overwhelmed. The literature suggests that a useful strategy is to use ICT to create challenging yet supportive learning experiences that involve customising instruction to meet the varied needs and preferences of students (Keuning & van Geel, 2021; Olimov, 2020). For example, Student 10, remarked, "When we use apps and websites that we're already familiar with from what we use to chat with friends, it makes schoolwork more interesting and fun." This helps create a more

personalised and inclusive Learning Environment (Huang, 2023; Newhouse, 2008b). The ability to adapt teaching methods to different learning styles is important in improving student comprehension and engagement (Tomlinson & Imbeau, 2023), thereby mitigating cognitive overload (Flynn, 2023). In short, using ICT as part of a strategy to provide scaffolding to students, while also acknowledging and addressing the different learning styles of students, is a strategy teachers can use to personalise learning and reduce information overload.

5.4.5.4 ICT Should Be Used to Positively Impact Classroom Pedagogy

The participants of this study indicated a concern that ICT is often not fully utilised. It was found that digital technologies are frequently just used in a way that substitutes for pen and paper. This underutilisation signifies a missed opportunity for transformative pedagogy.

The NISS framework details how the integration of ICT should lead to the Learning Environment having certain attributes (Newhouse, 2008b) that the research participants report is not always present within their Learning Environments. Students from all three schools reported that their use of digital technology was often limited to basic functions like research and typing assignments rather than using ICT to achieve higher-order tasks. To transform the learning experience, ICT needs to be used in ways that achieve the Learning Environment Attributes (LEAs) as defined in the NISS framework (Newhouse, 2008b). These include the use of ICT to increase interaction, collaboration, and creative problem-solving among students (Newhouse, 2017). For ICT integration to be effective, it needs the implementation of these pedagogical goals so that ICT use in schools is more than substitution and augmentation. Instead, its focus is on redefinition and transformation of the Learning Environment (Drugova et al., 2021).

The NISS framework emphasises the transformative role of technology in facilitating a shift from traditional, theory-dominated educational strategies to a more experiential, and interactive pedagogy (Herrington et al., 2014; Newhouse, 2017). This shift in focus is a paradigm shift in educational methodology, moving away from an overly theoretical orientation towards one that immerses students in the active exploration of real-world scenarios (Kerimbayev et al., 2020). Students transition from being passive receivers to

active participants, engaging actively with the subject matter, simulating real-world situations, and gaining access to a variety of global perspectives (Morley & Jamil, 2021). Utilising ICT in this way has been a success in many schools (Jesionkowska et al., 2020; Lombardi et al., 2021), including recently in rural schools in South Australia where they used video conferencing to engage students with industry professionals, demonstrating ICT's enabling potential to bring real-world expertise into learning environments that are geographically isolated (Barter, 2013; White, 2010). Such immersive and engaging learning experiences are important in bridging the gap between theoretical knowledge and practical application, making learning more relevant, tangible, and impactful for students (White, 2010).

The NISS framework explains how the use of ICT enables students to 'investigate reality' (Newhouse, 2008b), and use software and hardware to create rich, immersive Learning Environments. Emerging technologies such as Virtual Reality (VR) and Augmented Reality (AR) have the capability to 'transport' students to distant locations or different historical periods, providing them with an immersive experience of geographical or historical contexts. Schools that have implemented this have found it successful in improving learning by making abstract content more tangible and relatable (Garzón et al., 2020; McLauchlan & Farley, 2019).

The absence in the findings of this study of any mention or observation of participants using innovative technology such as Virtual Reality and Augmented Reality is significant. This indicates an area of missed opportunity, as numerous studies have demonstrated their high effectiveness (Dincelli & Yayla, 2022; Echeverri-Jimenez & Oliver-Hoyo, 2024; Rospigliosi, 2022). Importantly, Virtual Reality and Augmented Reality can actively engage students by providing interactive and immersive learning experiences that traditional methods are not capable of providing. For example, the use of Virtual Reality and Augmented Reality in subjects like chemistry (Echeverri-Jimenez & Oliver-Hoyo, 2024), biology (Wallgrün et al., 2024), physics (Wang et al., 2024), mathematics (Su et al., 2022) provide students with a more immersive exploration of complicated concepts, effectively transforming abstract theories into tangible and interactive learning experiences (Marougkas et al., 2024). These technologies improve the learning process and support contemporary learning needs by

making learning engaging and directly connected to real-world applications (Garzón et al., 2020; Scavarelli et al., 2021).

The emphasis on investigating reality through immersive technologies also plays an important role in the development of critical thinking and creative problem-solving skills. By engaging with learning material more interactively, students are encouraged to question, hypothesise, and experiment, often creating a deeper level of cognitive engagement. This active involvement in the learning process nurtures critical thinking skills and stimulates creativity (Børte et al., 2023; Kesler et al., 2022). Students are continuously challenged to devise solutions to real-world problems, an ability identified as important by scholars (OECD, 2018b; B. Thornhill-Miller et al., 2023), and sought after by employers (World Bank, 2021). Furthermore, this integration of ICT may increase the collaborative aspect of learning (Newhouse, 2008b). Technology enables connections beyond the classroom, enabling students to collaborate with peers, experts, and communities worldwide (Thornhill-Miller et al., 2023; Tohani & Aulia, 2022). This global interconnectedness improves the learning experience, broadening students' perspectives and understanding of different cultural and societal contexts (OECD, 2023b).

For teachers to achieve this, professional development is important (Mishra et al., 2023; Ong & Annamalai, 2023; Soto & Herrera, 2023). Tailoring effective teacher professional development programmes is fundamental for equipping educators with the skills and know-how required to integrate ICT effectively into their teaching practices (Davies & Willing, 2023; Omare, 2021; Sancar et al., 2021). Such professional growth plays an important part in narrowing the gap between the theoretical potential of ICT and its practical, effective application in learning environments (Gore et al., 2023; Patfield et al., 2022).

5.4.5.5 ICT Should Be Used to Implement Constructivist Pedagogies

The data gathered from teachers and principals during the interviews highlighted a reoccurring objective, which is to establish a Learning Environment in their schools that is rooted in constructivist principles. This is interesting because constructivism is a theory that continues to be relevant despite being started over a century ago, well before the invention of computers and the internet (Hatch, 2023; Reid-Martinez & Grooms, 2021; Triantafyllou,

2022). Constructivist methods emphasise the role of students as active agents in their learning and not merely as passive recipients of information (Packer & Goicoechea, 2000). It enables deeper understanding and more intellectually significant learning experiences by engaging students in the process of exploration and critical thinking (Müller, 2020). Teachers said that ICT enabled them to create more student-centred learning experiences. For example, Teacher 5 mentioned, "Using technology helps with projects where students can discover so much..." It encourages students to engage in inquiry, encourages introspection, and nurtures both intellectual and personal development (Education, 2020), thus, contributing to their growth and preparation for the 21-st century (Knight, 2023).

Implementing constructivist pedagogies in the classroom often results in the teacher's role transitioning from being the knowledge provider to a facilitator or guide (Archer, 1998; Kim, 2022; Ngussa & Makewa, 2014). This shift is important in enabling students to understand concepts themselves, an idea that was developed almost a century ago by Dewey (1938), who highlighted the importance of experiential learning. This pedagogical approach is in line with the Adventist schools' objective of providing learning experiences that have real-world relevance and encourage practical application and experimentation (Collado, 2020; Knight, 2016).

Implementing constructivist principles in the Adventist context can involve a variety of strategies like project-based learning, problem-solving tasks, and inquiry-based activities. These strategies encourage students to engage actively with the subject matter. For example, the field of robotics, which lends itself to discovery learning (Papadakis, 2020; Scaradozzi et al., 2020), mirrors the Adventist emphasis on practical, real-world applications of knowledge (Ngussa & Makewa, 2014).

The integration of ICT in constructivist Learning Environments can increase its effectiveness (Hatch, 2023; O'Connor, 2022; Triantafyllou, 2022). In Adventist schools, technology can be utilised as cognitive tools that support the construction and application of knowledge (Daboni, 2017; Jackson Nudd, 2022; Phillips, 2020). Cloud-based learning platforms can be utilised for collaborative projects, providing access to a wide range of information sources and simulating complex, real-world systems. This fits with the Adventist commitment to preparing students for contemporary challenges, while maintaining a strong spiritual and

ethical foundation (Knight, 2023). This, integrated with effective ICT use, can improve the learning experience, and equip students with critical thinking, problem-solving skills, and positive values, which agrees with the core objectives of Adventist Education.

Utilising ICT as a means to implement constructivist pedagogy can enhance the educational experiences in NZ SDA schools. Students, teachers and principals recognise that effective ICT integration is about leveraging its enabling potential to transform the learning environment. This approach compliments the Adventist educational philosophy of making the most of the resources available (Knight, 2016). By leveraging ICT to enable active, student-centred learning, educators can support students in becoming engaged, independent learners who are well-equipped for life upon leaving school.

To summarise, using ICT to implement constructivist pedagogy can enhance the learning experiences in NZ SDA schools. By integrating ICT, teachers can create student-centred learning environments that encourage active engagement leading to authentic learning. This complements the Adventist Education philosophy of holistic development, where the focus is on developing students' intellectual and moral aspects. The use of ICT can support the transition of teachers from knowledge providers to facilitators. It can provide students with the means to construct their own understanding through real-world learning activities. Therefore, using ICT within a constructivist framework can be an opportunity for NZ SDA schools to enhance their Learning Environment while remaining faithful to its philosophy of holistic education.

Chapter 6 Conclusion

6.1 Introduction

This thesis investigated the nature of Learning Environments in NZ SDA secondary schools, the role and impact of ICT within these environments, and the actions required at the system, school, and classroom levels to enhance the Learning Environment with an emphasis on the role of ICT. In this chapter, the research findings and conclusions are presented. In addition, it includes recommendations aimed at improving the Learning Environment through effective ICT integration.

6.2 Key findings

This study revealed that, overall, students have a positive perception of their Learning Environment. They view it as a safe and supportive place that is conducive to learning. The defining characteristics of the NZ SDA schools' Learning Environment were identified during this study. This resulted in a significant outcome of the research was the development of the Learning Environment Model, summarised below.

6.2.1 The Learning Environment Model

The Learning Environment Model illustrates the main characteristics of the learning environment in NZ SDA secondary schools. It is the culmination of an in-depth analysis of both qualitative and quantitative data collected through student surveys and interviews with students, teachers, and principals correlated with the relevant academic literature. The Learning Environment in NZ SDA secondary schools is characterised by 16 elements that are:

1. Pedagogical Strategies: Range from traditional to ICT-centred
2. Teacher Support: Teachers assist across all pedagogical strategies
3. Teacher-Student Relationships: Relationships enhance engagement
4. Special Character: Integration of academic, moral, and spiritual development
5. Open Dialogue: Dialogue encourages discussion and critique

6. Positive Environment: Students see it as positive and safe
7. State of Flux: Increasing use of technology
8. Appreciation of ICT: Students perceive it increases their engagement
9. Gather Information: Effective ICT use makes this possible
10. ICT Use: ICT is used across learning processes
11. Variability in ICT Use: Varies among teachers and classes
12. Financial: Resources constrain ICT availability and infrastructure
13. Collaboration: ICT use promotes collaboration
14. ICT Participation: Schools struggle with a digital divide and distraction
15. Relevant Learning: ICT use enhances real-world experiences
16. Flexibility: ICT Use promotes flexibility, adaptability, and resilience

The results from this study reveal that the 'Special Character' of the NZ SDA school system is deeply embedded in the schools included in the study (Element 4). Such an emphasis contributes to a holistic educational experience, nurturing students both academically and morally. Teachers in NZ SDA schools often go above and beyond their contractual duties, significantly influencing student learning (Element 2). For example, they run revision lessons after school hours and take an active interest in students' development outside of academic areas. This includes mentoring in extracurricular activities and providing moral and personal guidance. This dedication helps develop positive teacher-student relationships that increase engagement (Element 3).

Principals and teachers repeatedly highlighted their recognition that positive teacher-student relationships are essential for creating a positive atmosphere and increasing student engagement (Element 3). For example, Teacher 4 said, "…when students know we care, they're more engaged in learning." Students reported feeling valued and comfortable approaching teachers with academic and personal concerns. Such a nurturing atmosphere boosts engagement and also makes students feel safe and supported, which is an important element in a Quality Learning Environment (Klem & Connell, 2004). This, in turn, indicates high trust and support within the school (Element 5).

6.2.2 ICT and the Learning Environment

The findings of the study show that using ICT enhances the Learning Environment (Element 15). It significantly improves student engagement by making learning accessible and personalised (Element 8). Teachers reported using Learning Management Systems, such as Google Classroom, Office 365, and software like Kahoot, to make lessons more engaging (Element 7). However, this study also identified some negative aspects associated with ICT use. For example, digital distractions and excessive screen time divert students' focus from learning. Students, teachers and principals said this led to decreased academic performance (Element 12).

The findings confirm that NZ SDA schools are transitioning towards greater use of ICT (Element 7). Students repeatedly said that they enjoyed using ICT. They specifically mentioned that it increases their engagement and productivity (Element 8). All stakeholders agreed that learning is more efficient when ICT is used effectively. However, the use of ICT across subjects was variable, indicating that some teachers may require professional development in effectively utilising ICT (Element 11). Teachers and principals observed that in many lessons, ICT was used as a substitute for pen and paper or to gather information to produce written assignments (Element 9). It was not observed to be used innovatively in order to transform the Learning Environment, as suggested by Puentedura (2010) in the SAMR Model and Newhouse (2008b) in the NISS Framework.

Overall, the Learning Environment model supports existing research that has found that ICT can transform Learning Environments by engaging students in active and collaborative learning (see Mishra et al., 2023; Newhouse, 2008b; Puentedura, 2010). However, teachers felt they needed support in designing lessons that enable collaboration by utilising the collaborative functions of ICT (Element 10). All stakeholders agreed that ICT enables student autonomy by allowing students to take charge of their learning. Research has established that it can help teachers tailor instruction to meet individual student needs through relevant project-based work (Kokotsaki et al., 2016; Zhang & Ma, 2023). If implemented effectively, this can extend learning opportunities beyond the physical classroom, which principals identified as what they would like to actively pursue.

Teachers provided examples of projects related to current and national affairs where they effectively used ICT. For example, students participated in collaborative research on the

local effects of climate change, using shared online documents via Google Docs to gather data and present their findings (Element 10). According to the teachers, this approach covered the curriculum and developed students' digital literacy and research skills. By participating in these ICT-integrated lessons, students engaged in collaborative problem-solving which is an important 21st-century skill (Finegold & Notabartolo, 2010; Thornhill-Miller et al., 2023).

During the COVID-19 pandemic, NZ SDA schools transitioned to online learning under emergency conditions, demonstrating flexibility and adaptability (Element 7). This rapid shift enabled the continuity of education and lent weight to the findings regarding the transformative potential of ICT when effectively implemented (Element 15). The remote learning experience highlighted how ICT can engage students in active learning, facilitate peer collaboration (Element 10), and support the Learning Environment Attribute of knowledge-building (Newhouse, 2008b).

This study also identified negative issues associated with the increasing use of ICT within the learning environments of NZ SDA schools. The two significant concerns were the spread of inaccurate information and issues related to academic integrity (Element 12). For example, teachers in all three surveyed schools noticed an increase in plagiarism linked to students using Artificial Intelligence websites.

Teachers also mentioned that it was troubling that many students could not recognise what was false information. They lamented that many students accepted everything generated by Artificial Intelligence or from any website as true with little or no thought. Some teachers found it concerning that students lacked the critical evaluation skills necessary to discern credible sources from unreliable ones. According to teachers, this reliance on unverified online content erodes academic integrity and hinders the development of critical thinking skills (Element 12). Research indicates that increased use of ICT can lead to a false sense of security regarding the accuracy of online information (Rapp, 2016; Soetekouw & Angelopoulos, 2024).

These findings highlight the importance of helping students develop skills so that they can critically evaluate online information. The findings also demonstrate the need for teachers to

guide students in the responsible and ethical use of ICT. Principals recognised that addressing these issues is an important step in ensuring that ICT improves rather than diminishes the quality of the Learning Environment in NZ SDA schools.

The increased reliance on ICT can also lead to reduced personal interactions between students and teachers. This potentially impacts the development of social skills (Element 3). In addition, the digital divide remains a pressing issue. According to all stakeholders, many students lack access to devices and reliable internet connectivity, resulting in inequalities in learning opportunities (Element 14). Furthermore, digital distractions like social media and gaming were found to divert students' attention away from academic work (Element 14).

Recognising the negative impact of ICT, such as excessive screen time and digital distraction (Element 14), highlights the necessity for providing hardware and internet connectivity, carefully planning and delivering lessons that students find engaging. This is important because succumbing to digital distraction has been linked to negative outcomes, including reduced physical activity (Samarasekara et al., 2024), digital addiction, and impaired social skills (Flanigan & Babchuk, 2022). These dangers highlight the need for schools to find ways to enhance the advantages of ICT and reduce the negatives within the Learning Environment (Element 15).

Finding and implementing locally relevant strategies that reduce digital distractions has been established as essential in quality Learning Environments (Element 14). This can be achieved by teaching students self-regulation skills and techniques to stay focused (Flanigan & Babchuk, 2022). Teachers can incorporate lessons on time management and digital mindfulness, helping students concentrate on tasks without succumbing to non-educational content. Greater supervision and the use of monitoring software can help students remain on task during lessons. This will require an investment in personnel and ICT infrastructure, which principals mentioned is a struggle.

6.2.3 Key Implications and Recommendations

The findings support the idea that NZ SDA schools would benefit from continuing ICT incorporation, recognising its capacity to enhance Learning Environments and provide better

learning opportunities for students. As students often look to schools to equip them for success in life, schools should operate in a manner that effectively prepares them for future careers and challenges.

This collected data indicates that students across all three NZ SDA schools are more engaged in a quality learning environment that is ICT-enhanced mainly because ICT enables greater access to information and is often more engaging. This agrees with research that has found structured environments where ICT is effectively integrated into the curriculum can increase its benefits while reducing opportunities for distraction (OECD, 2023f). Therefore, NZ SDA schools can establish clear and enforceable guidelines for ICT use.

Schools should strive to balance lessons that extensively use ICT and traditional pedagogy. This balance can increase students' chances to benefit from both traditional and innovative teaching methods. Achieving this balance has been found to require continual professional development for teachers so they can enhance their skills and stay abreast of new teaching strategies, ICT innovations, and advancements. This will help address the variability in ICT use among teachers and classes and ensure that teachers are equipped to implement a range of pedagogical approaches in their classrooms.

Students are eager for real-world learning experiences that feel authentic and relevant. They desire an education that is meaningful and relevant to their future aspirations. The surveyed teachers recognise this need and are trying to engage students. ICT can serve as an enabler to enable this engagement. When effectively utilised, it enables interactive and engaging learning activities, as evidenced by positive feedback from students, who feel motivated and involved.

The effective use of ICT can boost student engagement and improve teacher-student relationships. By incorporating ICT into their pedagogy, teachers can connect with students in new ways, for example, by providing online tuition. In addition, ICT enables teachers to provide timely feedback. This can create a collaborative and interactive Learning Environment where students feel supported and understood. Combining face-to-face instruction with online opportunities, blended and hybrid learning models can build on teacher-student connections. Research has established that it can provide flexibility,

personalisation, and accommodation for different learning needs (Raes et al., 2020; Singh et al., 2021).

However, to enhance the Learning Environments of all NZ SDA schools through the use of ICT, urgent system-wide action is required. Analysis of the data from the study highlights significant gaps in the current ICT infrastructure that negatively impact the educational outcomes of students. While many other school systems are pouring money into AI initiatives and other major resource intensive ICT projects (see Imms & Mahat, 2022; OECD, 2023e), this study found that the surveyed NZ SDA schools have yet to follow suit. This points to the immediate need for increased funding. To address this issue effectively, the NZ SDA education system should proactively lobby potential funding sources. With extra funding, schools could upgrade ICT infrastructure and invest in professional development. These are are foundational practical steps that lift engagement and, in turn, achievement.

This study also identified that there is a need to establish centrally managed policies on ICT resource distribution to address disparities that were found across all SDA secondary schools. The SDA School System must implement equitable resource allocation that ensure students have access to devices. In addition, updating curriculum content to reflect contemporary global issues, such as digital literacy and global citizenship will further maintain the educational relevance of students' learning experiences. Additionally, given the increasing global shift towards hybrid educational models, in particular highlighted during the COVID-19 pandemic, therefore, the SDA system should invest in hybrid learning approaches across all schools. Policies need regular review, so schools stay flexible and ready for disruptions.

At the school level, modernising outdated infrastructure, such as cabling and servers, can't wait because it severely limits the educational benefits that can be derived from ICT use. SDA schools must actively seek and allocate substantial budgets for comprehensive infrastructure upgrades. There may also be a role for establishing external partnerships to help with this process. This should encompass hardware, software, and high-speed internet connectivity. Routine audits and infrastructure reviews should be conducted to guarantee the ongoing efficacy and appropriateness of ICT infrastructure. In addition, digital learning platforms, such as Google Classroom and Moodle, should be widely adopted across SDA

schools to support continuous and flexible learning. To optimise these platforms' effectiveness, professional development and technical support for school staff is necessary.

Addressing digital distraction was also identified as a major finding within this study. Schools need to be very proactive in this space and a solution may be found in the development and implementation of digital management strategies that include monitoring software and targeted student training sessions that focus on self-regulation and digital citizenship education that is embedded into the curriculum across all year levels. A teacher's focus in the classroom should be on student engagement in learning. Mandatory and ongoing professional development programmes should equip teachers with current and effective ICT pedagogical practices to sustain and improve student engagement.

Within NZ SDA schools, there is a need to address issues of equity. Establishing inclusive device-loan or subsidy schemes, coupled with effective cybersecurity measures, including internet filtering, can ensure online safety and equitable device access for all students. Additionally, training should be introduced to equip students with ways that they can effectively navigate and deal with misinformation online. Explicit instruction in online content verification skills must become a standard component of classroom practice. There needs to be regular activities designed to enhance students' critical thinking and evaluation abilities. Teachers should periodically assess student proficiency in these skills and offer targeted interventions where necessary. Given that new threats are always emerging, teachers should also continually have professional development in keeping themselves abreast in strategies to evolving misinformation trends.

Within the classroom context, teachers should use constructivist pedagogies appropriately to help develop active, student-centred learning environments. As discussed previously in this thesis, research evidence supports that many students are more engaged when there is a reduction in traditional didactic teaching methods in favour of ICT-enabled, student-initiated projects. This promotes student autonomy and deeper engagement with curriculum content. Teachers need to balance ICT integration thoughtfully with traditional face-to-face instructional methods to ensure a holistic educational experience that aligns with the SDA education ethos. Regular professional development sessions should support educators in confidently incorporating interactive technologies such as the use of artificial intelligence,

educational games, augmented reality, virtual reality, and others that have the potential to significantly enhance student engagement and participation. Additionally, having more personalised interactions with students via ICT will allow educators to deliver individualised feedback and targeted support, resulting in stronger teacher-student relationships and enhancing learning outcomes. Teachers should regularly seek student feedback on these interactions to refine their approaches continuously, incorporating data-driven analytics to inform personalised learning experiences further.

Integrating practical, ICT-enabled, hands-on activities should be routine in classrooms, promoting creativity, problem-solving, and collaboration among students. Encouraging student autonomy through project-based learning tasks using ICT will empower students to innovate and independently explore educational content. Regular utilisation of educational games, simulations, and interactive digital resources is recommended to significantly boost student motivation, enjoyment, and learning depth. Collaborative project-based ICT learning activities should consistently be employed to develop essential 21st-century skills, such as teamwork, effective communication, and creative problem-solving. Finally, teachers should extend educational experiences beyond the classroom via virtual platforms, including digital field trips and international collaborative projects, to broaden students' global perspectives and intercultural understanding, ensuring regular evaluations to maintain alignment with educational objectives and student needs.

6.3 Limitations of this Study

Although significant efforts were made to minimise limitations, all research contains limitations (Price & Murnan, 2004). Recognising limitations is important for contextualising the findings and understanding the scope within which the results can be interpreted and applied (Creswell, 2014; Greener, 2018).

6.3.1 Methodological Limitations

One significant limitation of this study is the sample size. This study focused on NZ SDA secondary schools, which may not be representative of all secondary schools in NZ. Consequently, the findings may have limited generalisability to other schools. In addition, participants in this study were selected because of their willingness to participate. This voluntary participation may introduce sampling bias, as students with a particular interest or proficiency in ICT might be overrepresented. This could skew the results, resulting in a more frequent or advanced use of ICT than what is typical.

Another limitation relates to this study's reliance on self-reported data from teachers, principals, and students. Self-reported data can be influenced by respondents' perceptions, which may not always accurately reflect reality (Brutus et al., 2013; Chan, 2010). For example, teachers and principals who are enthusiastic about ICT might overestimate its effectiveness or downplay the dangers associated with its implementation. Similarly, students might report higher engagement and satisfaction levels due to a desire to please the researchers or because they associate technology with entertainment rather than learning.

This study did not capture detailed technical data on ICT infrastructure and support across different schools. Differences in internet speed, availability of devices, and technical support can significantly impact the effectiveness of ICT integration (Newhouse, 2015b; Siswanto et al., 2021). It is well established that the level of resources available to a school can greatly influence how successfully it implements ICT (Imms & Mahat, 2022; Newhouse, 2008b). For instance, a well-funded school might have access to the latest computers, high-speed internet, and dedicated IT support services. This would be advantageous to students and teachers. On the other hand, schools with limited resources may struggle because of their

infrastructure limitations. This variability in resources means that comparing ICT implementation across different schools can be difficult. For example, a study showing positive outcomes in a well-resourced school might not be replicable in a school with fewer resources. As a result, the findings from one school may not be applicable to another.

6.3.2 Analytical Limitations

While this study aimed to investigate the role of ICT in enhancing the Learning Environment, establishing causal relationships between factors is problematic (Jensen, 2022; Koopmans, 2014; Maxwell, 2012). The research design in this study, primarily observational and correlational, does not allow for definitive conclusions about causality. Experimental or longitudinal studies may be better suited to ascertain causal effects.

The many factors in a Learning Environment further complicate causal inference (Jensen, 2022). Variables such as teaching methods, student demographics, socioeconomic factors, and school culture interact in many ways that are not easily isolated in a correlational study (Hopwood et al., 2022). Experimental-based longitudinal studies, which involve manipulating specific variables or observing changes over an extended period, may be better suited to ascertain causal effects (Jensen, 2022); however, scholars have pointed out that such studies may not be possible due to ethical issues (Maire, 2024). However, standard longitudinal studies can help control factors, possibly providing evidence of the direct impact of ICT on student learning outcomes. This can provide insights into the sustained effects of ICT integration in schools (Field, 2011; Putz et al., 2020).

6.3.3 Differences between schools and within each school

A limitation of this study is differences within each school and between schools. It is well-established in the literature that no two schools are the same (Agasisti et al., 2023; OECD, 2023a). Each school can have different challenges around ICT integration, such as varying levels of access to technology, differences in teacher proficiency with ICT, and policies regarding ICT use. Within a single school, there can also be significant variability in how different teachers utilise ICT in their classrooms, the types of ICT devices available, and the student engagement levels. These intra and inter-school differences can lead to varied

outcomes that this study might not have accurately captured. As a result, the findings may not reflect the full spectrum of ICT use and its impact on student learning within each individual school.

There are other factors between schools that could provide further insights if investigated in more detail. Factors such as the socioeconomic status of the student population, the funding levels for technology, administrative support for ICT initiatives, and the professional development opportunities available for teachers can vary widely between schools. These inter-school differences can significantly influence the effectiveness of ICT integration and its pedagogical outcomes (OECD, 2023d). By not accounting for all these variances, this study's results might have overlooked significant contextual elements that affect ICT implementation and success. Future research can utilise a more granular methodology, examining both within-school and between-school differences to provide a more in-depth understanding of how ICT can be effectively used to enhance learning experiences.

6.3.4 Rapid Technological Changes

This study was conducted over a specific period, during which school administrators and teachers reported that they are actively modifying their practices to further incorporate and enhance the use of ICT within their Learning Environments. These ongoing developments reflect the increasing digitisation of Learning Environments, which can significantly impact the day-to-day running of schools (OECD, 2023e). The swift pace of technological development and innovation means that some of the findings from this study may become outdated quickly, therefore limiting its long-term applicability.

6.3.5 Areas for Further Research

The results of this study have identified some specific areas for further research. Given this is the first study that focuses on ICT within NZ SDA secondary schools, it adopted a broad methodology. In doing so, it identified several areas of strengths and weaknesses that provide opportunities for more granular, in-depth, and longitudinal studies.

One significant area identified involves the financial constraints highlighted by all research participant groups, that is, the students, teachers, and principals. These are significant barriers to the effective use of ICT within Learning Environments. Future research dedicated to examining these financial issues could discover how such constraints impact the efficacy of ICT within the Learning Environments and identify strategies for overcoming these barriers. In addition, studies examining the effects of targeted professional development programmes on teachers' abilities to effectively utilise ICT can result in the development of policies that increase teacher proficiency in ICT. Such research could identify the most effective methods for upskilling teachers so that they are adequately resourced to effectively integrate ICT into their pedagogy.

As discussed earlier, longitudinal studies are particularly useful in education research involving digital technology (Field, 2011; Raes et al., 2020). These studies can provide insights into how educational interventions and innovations impact student academic performance, digital literacy and career readiness over time, allowing researchers to track developmental trends and long-term outcomes (Raes & Depaepe, 2020; Valtonen et al., 2019). By following students over extended periods, researchers can evaluate how ICT influences future educational achievements and employment. It would enable teachers and school administrators to make evidence-based decisions about how to best integrate ICT in ways that benefit all students, and to develop targeted interventions and support systems to address any negative outcomes. For NZ SDA schools, where research on ICT integration is limited therefore longitudinal research is likely to provide additional significant data.

Further research can also address the specific barriers identified in NZ SDA schools, such as inadequate teacher training and infrastructural deficiencies. This is because developing scalable and sustainable solutions is an area of ongoing interest, especially within the OECD (OECD, 2023d, 2023e).

While this study did not specifically focus on investigating the factors that facilitated the smooth adaptation of NZ SDA schools to remote learning during the COVID-19 pandemic, the results point to an intriguing area of research. The ability of NZ SDA schools to effectively manage the transition to online learning under emergency conditions during the COVID-19 pandemic lockdowns and to maintain a positive learning experience for students

can serve as a model for resilience in crisis situations. By exploring the strategies that enabled NZ SDA schools to maintain effective learning during the COVID-19 pandemic lockdowns, future research could yield practical benefits. Such studies would highlight the successful approaches of these schools and possibly provide valuable lessons for others. Gaining a thorough understanding of these strategies could reveal how resilience affects institutional achievement.

In addition, the rapid innovation of ICT requires one to examine the ability of new technology, such as Artificial Intelligence and Virtual Reality, to enhance learning. Recent reports indicate that these technologies, while expensive, hold promise for improving academic outcomes by creating more immersive and interactive learning experiences (Forristal, 2024; META, 2024).

Recent scholarly research highlights the importance of conducting comparative studies in education and technology (Agasisti et al., 2023; OECD, 2023h). Most of the OECD publications on education and technology are comparative studies (Habibi & Zabardast, 2020; OECD, 2023a, 2023e). This highlights the substantial value of conducting comparative studies across different schools to identify best practices in ICT integration. Such research could identify specific strategies that may help other schools.

It would be beneficial to investigate how pedagogical strategies that incorporate technologies like Artificial Intelligence and Virtual Reality impact student engagement and learning outcomes. Financial constraints often hinder the procurement of such technologies; thus, empirical evidence demonstrating their benefits could prove important. These investigations can evaluate the needs and learning styles of students to tailor pedagogy that maximises engagement in ICT-enhanced Learning Environments.

6.3.6 Conclusion

This study investigated the Learning Environments of NZ SDA secondary schools with a specific focus on the role of ICT. It examined how Learning Environments may be enhanced using ICT and identified ways that changes at the system, school, and classroom levels could improve students' learning experiences. The research revealed that students generally

perceive their Learning Environments positively, viewing them as safe and supportive places conducive to learning. A significant outcome was the development of the Learning Environment Model (Figure 5.1).

However, this study also identified negatives associated with ICT use, namely, digital distractions, unequal access to technology, and the underutilisation of ICT's transformative potential. To maximise the benefits of ICT, it is recommended that NZ SDA schools address these barriers by securing adequate funding, providing ongoing teacher professional development, and implementing strategies to minimise digital distractions. Balancing traditional pedagogy with innovative ICT practices is an important step in creating more engaging, equitable, and effective Learning Environments.

While the findings provide actionable insights, there are limitations such as the reliance on self-reported data. Also, the variability between schools and rapid advancements in ICT may affect the long-term applicability of the results. Future research could focus on longitudinal studies to assess the long-term impact of ICT on student learning. It could also look at strategies that enabled effective remote learning during the COVID-19 pandemic and investigate the integration of emerging technologies like Augmented Reality and Virtual Reality. By addressing the identified areas of improvement, NZ SDA schools can continue to adapt and innovate, enabling ICT to serve as a transformative tool.

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Chapter 8 Appendices

8.1 Appendix 1. Principal Interview Questions

Principal Interview Questions

1. Request to record the interview electronically.
2. Roles at school.
3. Years at current school.

What Learning Environments are currently established in your school?

What impact in your opinion has BYOD had on your school?

What strategies were used this year to increase the use of ICT to support learning?

What plans are there to increase the use of ICT to support learning in the school?

What value do you see in the role of Curriculum ICT coordinator?

Can you identify some impediments to ICT integration within your school.

Are there any responses which you gave in this interview that you would like to qualify or expand upon?

8.2 Appendix 2. Teacher Interview Questions

Teacher Interview Questions

4. Request to record the interview electronically
5. Roles at school
6. Years at current school

Aims as a Teacher

7. What are your main aims as a teacher? What are you trying to achieve at this school?
8. Think of activities you have conducted with your classes over the past TERM. What are the best examples to illustrate how you are achieving your aims?
9. How much do you use technology to help you achieve your aims?

Technology at School & Learning and Teaching

10. What do your students use technology for at school? Give us some examples.
11. What are the main purposes for which you want to facilitate ICT use for students?
12. Has your use of technology influenced the pedagogy you use in the classroom (the way that you teach)?
13. How does using technology in the classroom help students to:
    a. Reflect and interact with the real world?
    b. Develop their collaborative learning skills?
    c. Require them to communicate with others?
    d. Is tailored to individuals or groups of students? - differentiated learning
    e. Develop higher order thinking skills?
    f. Allows students to build their own knowledge? - student centred learning
14. How engaged are your students in learning?
    a. What strategies have you used this term to engage student interest and activity?
15. In what ways do you think the use of ICT in the classroom helps students to see their subject as being more relevant? (connects students to the way ICT is used in society)
16. How would you rate the ICT knowledge and skills of your students?
17. Does your use of ICT influence your assessment of students?

School Capability

18. Is computer availability an issue at your school?
19. How would you describe the ICT Network in your school generally?
20. What is the main software used with students?
21. Do you feel that you get enough support from the school to facilitate ICT use in the classroom?
22. How do you keep yourself up-to-date professional learning with knowledge and skills in facilitating the use of ICT by students?

23. What concerns do you currently have for the way in which ICT is used to support learning and teaching?

Home Use

24. Does the use of technology impact on the personal lives of students at home?

Future Use and Lessons from COVID

25. What is your attitude? Do you plan to continue to use ICT at school in the future?
26. How did you adjust to remote learning during COVID?
27. What lessons do you think we can learn from COVID? What should the school keep doing?
28. Hybrid Learning - Learning Hubs

Optional Questions (if necessary)

30. What are some specific tasks students have used computers for? For example, students may have used a word processor to construct an essay.
31. Type of activities and pedagogy
    What activities or projects have been supported by computer use over the last term?
32. project work, maths skill practice, science investigations)
33. What did the students do and what did you do? (e.g. find information, class discussion using projector).
34. How did you decide whether to use computers to support learning?

Frequency or use

How often do your students use ICT?
Is there any pattern to your ICT usage? (e.g. every Friday) Do they work independently or in groups?

Implementation strategies

35. What teaching strategies do you use consistently when ICT is involved? How do you decide on the strategy you use?
36. Student/Teacher Roles
    What do you see as your main roles when using ICT with your classes? What roles do the students have?
    What support do your students have in their use of computers?
37. Student ICT Skills
    How would you rate the ICT knowledge and skills of your students? Upon what do you base this judgement?
38. In what ways are students permitted to contribute to decisions about the use of ICT?
39. Curriculum Outcomes
    In what ways does the use of ICT by your students support the demonstration of the
40. curriculum outcomes?
    What curriculum outcomes are you addressing with the help of ICT?
41. 33. The relevance of ICT to content
    In what ways do you connect what the students do with ICT and the way ICT is used in our society?
42. Have you assessed work that students have done with ICT?
    How has this been included with your overall assessment processes? How important is the use of computers to your assessment processes?
43. Applications
    What applications do you use, and which ones have you most recently learned to use?
44. Rate your skills in using applications software?
45. Online Services
    What online services and tools do you use, and which one have you most recently learned to use? Rate your skills in using online services? Rate your skills in using online services?

46. Peripherals
    What devices do you use?
    Rate your skills in using peripheral devices?
47. How do you keep yourself up-to-date professional learning with knowledge and skills in facilitating the use of ICT by students?
48. Do you have a role in helping other teachers with this?
49. What involvement do you have with Working collaboratively on facilitating the school the use of ICT (learning communities)?
50. What support do you receive from others in the facilitation of ICT for learning?
51. What potential do you see or ICT to support learning and teaching processes with your class?
52. How do you feel when you use a computer and when you support your students in using computers?
53. Concerns What concerns do you currently have for the way in which ICT is used to support learning and teaching?
54. How do you contribute to school ICT planning?
55. What would you like to contribute?
56. Changes or steps to change
    What changes or steps to change are you making at the moment?
57. Support required to progress
    These may address barriers to progression on any of the elements discussed earlier.
58. Best example of use of ICT (selected by teacher)
59. Technology Education Programme (where relevant)
60. Typical example for teacher (selected by researcher)
61. Student Work Samples or Portfolios
62. Student Work Samples or Portfolios A set of work samples for a learning Complete activity involving ICT focussed on students working individually
63. A set of work samples for a learning | Complete activity involving ICT focussed on students working in a small group

8.3 Appendix 3. Student Interviews

Student Interview at (Name of School)

1. Request to Record Interview, Student Year Level
2. List some activities that you have done at school over the last few weeks that have been interesting.
3. Have you used any ICT skills to help you in completing these activities?
4. Do you think that getting a good education is important?
5. What do you do at school that you think is important? Why?
6. How often do you use computers at school?
7. What sort of things do you usually do on the computers?
8. Has the technology in the school helped to make school more important or interesting for you?
9. Did you have an opportunity to share your work with others?
10. What would school have to be like to make it interesting?
11. How did using computers make you feel about learning?
12. Do you think that the teachers are teaching you in a different way than before the technology was there?
13. Think about a recent activity you did with your teacher that involved solving a problem.
14. Did the use of technology help you solve the problem?
15. When you search for information on the web (internet), how do you decide which is the most important information?
16. Do you work in groups at school? Does the use of ICT help group work?
17. How did you share the work and ideas, and make decisions?
18. Give an example of group work and how computers might help you make decisions?
19. Have you had any problems with using computers at school this year?
20. If you have a computer at home, what do you use it for?
21. Any other comments about using computers at your school?
22. What was your learning experience during COVID?
23. Did ICT help you to learn during that time?
24. Looking back what advice do you have for your teachers?

8.4 Appendix 4. Student Survey



Student Questionnaire

Student Questionnaire

This questionnaire is being used to survey a sample of students from schools involved in PhD research by Ryan Gounder. This questionnaire will take on average 15 minutes.

This is an anonymous questionnaire. By completing the questionnaire you are consenting to take part in this research. Your responses will be strictly confidential, only Ryan Gounder and his Supervisors at Avondale University will see your particular responses. The information will be collated with no reference to individuals and no identifying information for reports to the school and department. Such reports will only include general and summary information and will in no manner identify individuals. You may contact the principal researcher Ryan Gounder on s16122155@student.avondale.edu.au Phone 021 685 003 or this supervisor Dr Peter Beamish peter.beamish@avondale.edu.au if you have any queries.

Please note in this research "computer" and "ICT device" is used interchangeably.

1. Name of School:

- ☐ Auckland Seventh-day Adventist High School
- ☐ Longburn Adventist College
- ☐ Christchurch Adventist School
- ☐ Hamilton Seventh-day Adventist School
- ☐ Palmerston North Adventist Christian School
- ☐ Parkside Christian SDA School
- ☐ Southland Adventist Christian School
- ☐ South Auckland SDA School
- ☐ Waitakere SDA School
- ☐ Whangarei Adventist Christian School
- ☐ Whakatane SDA School
- ☐ Balmoral SDA School

2. What year level are you in?

- ☐ Year 6
- ☐ Year 7
- ☐ Year 8
- ☐ Year 9
- ☐ Year 10
- ☐ Year 11
- ☐ Year 12
- ☐ Year 13

3. My Age is

- [ ] 10 years of age
- [ ] 11 years of age
- [ ] 12 years of age
- [ ] 13 years of age
- [ ] 14 years of age
- [ ] 15 years of age
- [ ] 16 years of age
- [ ] 17 years of age
- [ ] 18 years of age

4. Think about all the things you do for school at the moment. For each sentence below decide how often it was true for you. Then circle/tick one of the words at the end of the sentence.

	Mostly	Often	Sometimes	Rarely
I do things at school that are good for me	○	○	○	○
I do things at school about the world	○	○	○	○
I look for information to solve a problem	○	○	○	○
I use new information for my school work	○	○	○	○
I help to decide what to do at school	○	○	○	○
I work as fast or slowly as I like in class	○	○	○	○
I share my ideas with a group I am working with	○	○	○	○
I am given a mark or grade on the things I do in class.	○	○	○	○
I find the things I do for school a little difficult	○	○	○	○
I am really interested in the things I do	○	○	○	○
I show my work to my class	○	○	○	○
I use information to make decisions about my work	○	○	○	○
I do reports on what I find out	○	○	○	○
I am given help to learn	○	○	○	○
I find it easy to work and learn	○	○	○	○

5. Think about how you use ICT devices (these include tablets, phones, laptops, etc) AT SCHOOL at the moment. For each sentence below decide how often you used computers in that way. Then circle/tick one of the words at the end of the sentence.

	Often	Sometimes	Rarely	Never
I have learned things using computers	○	○	○	○
I have typed stories or reports on a computer	○	○	○	○
I have drawn pictures using a computer	○	○	○	○
I have made videos or sound recordings using computers	○	○	○	○
I have put information that I have found into spreadsheets or databases	○	○	○	○
I have used email to communicate with people	○	○	○	○
I have googled for information to complete my work	○	○	○	○

6. If you use your ICT device for other things at school, please describe what you use it for.

7. Think about the times you use computers AT SCHOOL at the moment. For each sentence below decide how often it is true for you.

	Mostly	Somtimes	Rarely	Never
I am comfortable using computers for my work in class	○	○	○	○
The work I complete using computers is important	○	○	○	○
The work I do using computers is interesting	○	○	○	○
Using computers has helped me to do difficult things	○	○	○	○
I try hard to finish work I do on computers	○	○	○	○
I make sure I am in class when we use computers	○	○	○	○
I can decide to use computers for my work	○	○	○	○
I use computers at home	○	○	○	○

8. How much time did you use a computer at school LAST WEEK on Monday?

Number of hours on the computer on Monday

0 — 7

9. How much time did you use a computer at school LAST WEEK on Tuesday?

Number of hours on the computer on Tuesday

0 — 7

10. How much time did you use a computer at school LAST WEEK on Wednesday?

Number of hours on the computer on Wednesday

0 — 7

11. How much time did you use a computer at school LAST WEEK on Thursday?

Number of hours on the computer on Thursday

0 7

12. How much time did you use a computer at school LAST WEEK on Friday?

Number of hours on the computer on Friday

0 7

13. Things I find hard about using computers at school to do my work is?

14. Somethings I really like about using computers at school to help me learn is?

15. Somethings I would like to know more about when using computers at school to help me learn is:

16. Please rate yourself on word processing (Microsoft Word, Google Docs)

- [ ] I can't do much
- [ ] I can use fonts, type in words, check the spelling and print
- [ ] I can make the page look good, add a footer and page numbers
- [ ] I can put in pictures, make tables, change the Page Setup, change margins

17. Please rate yourself on spreadsheets (eg Microsoft Excel, Google Sheets)

- [ ] I cannot do much
- [ ] I can type in numbers
- [ ] I can make charts (graphs) and change them
- [ ] I can put in calculations, and add and delete rows and columns

18. Please rate yourself on databases

- [ ] I cannot do much
- [ ] I can type in numbers and words, and I can look for information
- [ ] I can use simple queries to get information
- [ ] I can make simple data tables. I can use wizards to create reports and forms.

19. Please rate yourself on Slideshow software (eg PowerPoint, Google Slides)

- [ ] I cannot do much
- [ ] I can look at a slideshow and put in words
- [ ] I can put pictures in a slideshow, and use fonts and layouts
- [ ] I can jump between slides when I show a slideshow. I can add animations, transitions and hyperlinks

20. Please rate youself on email

- [ ] I cannot do much
- [ ] I can read an email and send an email
- [ ] I can get my emails and use an Address book or Contacts List
- [ ] I can put messages in folders. I can find Sent and Deleted messages. I can create groups

21. Please rate yourself on computer file management

- [ ] I cannot do much
- [ ] I can save files in a folder, and look in different folders on the screen
- [ ] I can make new folders, and copy, get rid of and do new names for file
- [ ] I can see different file types. I can go to different drives and directories on the network and I can use help files.

22. Please rate yourself using a web browser (eg Explorer, Google Chrome, Safari, Firefox)

- [ ] I cannot do much
- [ ] I can use the Internet to click on finks. I can go to a web site if I am told the address to type.
- [ ] I can make a Favourite and can use a search
- [ ] I can save pictures and text from web sites. I can organise my Favourites and do and do advanced searches

23. Creating web pages (creating a website)

- [ ] I canot do much
- [ ] I can make a web page with words and pictures
- [ ] I can put links in my web pages. I can change what my web pages look like. I can use various fonts.
- [ ] I can put tables in my web pages. I can create links to other web sites and email addresses.

24. Please rate yourself on digital photography

- [ ] I cannot do much
- [ ] I can take photos or videos using a camera.
- [ ] I can move my photos or videos to the computer.
- [ ] I can look at photos or videos on the camera. I can adjust camera settings such as flash and close-up settings.

25. Please rate yourself on image processing

- [ ] I cannot do much
- [ ] I can draw pictures using a computer
- [ ] I can change pictures using a computer
- [ ] I can change picture size, file format and apply filters

26. Please rate yourself on video editing

- [ ] I cannot do much
- [ ] I can move my videos on the computer.
- [ ] I can delete parts of my video that I don't like. I can join my videos together.
- [ ] I can put titles, transitions and sound effects into my videos.

27. Please rate how many hours a day you spend on video streaming websites such as Youtube, Netflix, Disney+, etc

0 Number of hours 12

28. What social media service do you spend the most time on?

29. How many hours a day do you spend on the above mentioned social media service

1 Hours 12

30. Please rate how many hours a day you spend on Facebook?

0 Number of hours 12

31. Please rate how many hours a day you spend on Instagram

0 Number of hours 12

32. Do you play video games?

- Yes
- No

33. What video games do you play?

34. How many hours a day do you play your favourite video games?

0 12

8.5 Appendix 5. Learning Environment Model Elements Mapped to Research Questions

Learning Environment Model Elements	Research Question 1	Research Question 2	Research Question 3
1. Pedagogical approaches that range from traditional to ICT-centred	✓	✓	
2. Teachers are supportive and assist with all pedagogical approaches	✓		
3. Positive teacher-student relationships that enhance engagement	✓		
4. A Special Character that includes academic, moral, and spiritual development	✓		
5. A positive environment perceived by students to be safe	✓		
6. Discussion and critique that encourages open dialogue	✓		
7. There is an increasing use of ICT		✓	
8. Students enjoy using ICT as they perceive it increases their engagement		✓	
9. ICT is often used to gather information		✓	
10. ICT is often used to collaborate between students and teachers		✓	
11. ICT use varies among teachers and classes		✓	✓
12. There are issues of digital distraction and harmful content			✓
13. There is a digital divide; many students rely on school-owned devices which they cannot take home			✓
14. Financial resources constrain ICT availability and ICT infrastructure			✓
15. ICT is perceived to enhance the Learning Environment		✓	✓