Digitally-supported collaboration:

An exploration of teachers' and students' understandings and practice.

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Abstract

Education is evolving over time. The use of digital technology in our schools continues to grow and develop at a rapid pace, supported by the introduction of ultra-fast broadband and the availability of mobile technology. There is change occurring in the teaching and learning environments in our schools, walls are coming down between classrooms and teachers are increasingly being expected to work in co-teaching situations. An expectation is being set that educators need to equip students with the 21st century skills necessary to be successful in today's world, one of the key skills being the ability to collaborate with others.

This study draws together the key ideas introduced above - that is, developing knowledge of collaborative, digitally-supported innovative learning environments (ILEs). A collective case study approach was used to investigate the understandings teachers and students in three primary schools have about collaboration, and how this was reflected in practice. This interpretive study also explored the nature of digitally mediated interactions occurring in these learning environments including teacher-to-teacher, teacher-to-student, and student-to-student, to gain a better understanding of any role digital technology might play in collaborative teaching and learning within these spaces.

Data was collected through observations, interviews, and the collecting of artifacts. These data were then analysed thematically. The findings suggest that building trusting relationships is essential to collaboration but can take time to establish. Teachers and students need to have a shared understanding of what collaboration is and their role within this. *Clarity of purpose* is fundamental to effective digitally-supported collaboration, teachers and students need to know why they are collaborating, how digital technology could support their collaborative needs, and how they can best make use of their physical environment.

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Chapter One: Introduction

This chapter provides an introduction to this study. It outlines the significance of the study, personal motivation of the researcher, the research question and context, and the structure of the thesis.

Significance of Study

Digital technology has become an increasingly familiar feature in many classrooms. While the use of digital technology has grown, research has indicated that many barriers exist which lessen its intended impact on teaching and learning (Ertmer, 1999; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Hew & Brush, 2007; Tsai & Chai, 2012). One of these barriers is a lack of understanding of how to use digital technology in a collaborative manner, possibly due in part to a lack of research in this area (Higgins, Mercier, Burd, & Hatch, 2011).

Collaboration is a skill noted by the Programme for International Student Assessment (PISA), as crucial in the 21st century workplace, and needing to be further developed in students (Cho, 2015; Davidsen & Vanderlinde, 2016). However, research suggests that collaboration can be an unclear concept for teachers, who while often aware of the benefits of collaboration, can be unsure how to incorporate this into practice (Cho, 2015; Fisher, Lucas, & Galstyan, 2013; Scalise, 2016). This uncertainty has become even more pronounced with the introduction of innovative learning environments – flexible, modern classroom spaces where the collaborative use of digital technology is viewed as a key element of teaching and learning (Ciampa, 2014; Niemi & Multisilta, 2015).

Furthermore, there is a lack of empirical research about innovative learning environment/digital technology/pedagogy blends at present, yet

teachers are increasingly required to teach in these environments, with the expectation of improved learning outcomes for students. It is expected that all schools in New Zealand will have modernised their teaching spaces by 2022 (Ministry of Education, 2011), however as found by Blackmore, Bateman, Cloonan, Dixon, Loughlin, O'Mara and Senior (2013, p.13), little research has been conducted on how schools prepare for, and make changes to practice as they move into these new learning environments.

Personal Motivation

I have been working in a digital-classroom environment for the past 10 years and over that time have developed a keen interest in how digital technology can be used to engage, inspire and motivate both students and teachers. I noticed that my classroom environment needed to change physically and pedagogically to support and enable the type of teaching and learning made possible through the use of digital technology.

I aimed to create a space which could adapt to *our* needs. A range of furnishings allowed students to work in a variety of ways – sitting, standing, lying down, individually, or in groups. The furniture was also used to create different learning spaces in the classroom, with the outside decking becoming an extension of the room - with desks or beanbags moved outside as required. In my second year, we moved into a newly built learning environment which offered even more flexibility with regards to how we could use the space. The teaching and learning that occurred during this time became increasingly student-focussed and collaborative, driven in part by my own pedagogy, but also influenced by the seemingly natural way students wanted to collaborate using digital technology.

In 2015 I had the opportunity to explore the concept of co-teaching and so started working with a colleague in a class of 65 students. I quickly realised the power that could come from working alongside another

professional teacher. This experience helped me recognise how isolating classroom teaching traditionally is, and, while this experience was challenging at times - as we had few models to draw from, it highlighted how much can be gained from collaborating with others. Collaboration has become a worldwide life skill that is increasingly needed by all people of all ages, as we now live and work in environments that demand increased collaborative interactions with a wider range of people (Cho, 2015; Correia, 2015). I have come to see this skill as a vital component of working in a digitally-enhanced classroom environment - but not an easy skill to master.

Research question and context

In my current school, more of our teachers were now working in co-teaching spaces, integrating digital technology into teaching and learning, and exploring the concept of collaboration for both themselves and their students. New classrooms were being built, and old classrooms renovated, creating learning environments which were flexible and adaptable to our needs. However, one of the challenges we faced as a school was a lack of current research, resources, or examples - to help us better understand the areas we were integrating (learning environments, collaboration, digital technologies). Through conversations with teachers and leadership in other schools, it became very apparent that we were not the only school facing these issues with many schools having to *find their own way*. This challenge formed the basis for my research, therefore the aim of this study was:

To explore principles underpinning the development of collaborative learning environments in three primary schools, and any role digital technologies play in establishing and sustaining these.

The questions underpinning this aim were:

1. What are teachers' and students' understandings of collaboration, and how is this established in their classrooms?

2. Do teachers and students consider digital technology plays a role in establishing and sustaining this collaboration, and if so, how?

3. How do teachers and students consider digital technology-supported collaboration influences teaching and learning in their classrooms?

By focusing on classrooms with an established strength in digitally-supported collaborative practice, this study aimed to provide practical information, *based on current practice*, to support and encourage schools and teachers at the various stages of their learning journey.

There are several terms which can be used when discussing *digital technology* such as IT (information technology), and ICT (information and communication technology). For consistency in this thesis, the term *digital technology* will be used – except in the case of direct quotations.

Structure of the Thesis

This thesis is organised into six chapters. This chapter discusses the significance of this study, and shares background information about the researcher. It then introduces the research question and context, before ending with an overview of the thesis. The second chapter reviews relevant literature on digital technology, collaboration, and innovative learning environments – also looking at research about how these concepts interrelate. Chapter three details the research methodology, including the theoretical framework, research method, data collection, research process, data analysis, and ethical considerations. The findings that arose from thematic analysis are outlined in the fourth chapter, and are discussed in detail in chapter five – alongside any implications. Finally, the sixth chapter concludes the study by presenting a summary of key findings, limitations of the study, and areas for possible future research.

Chapter Two: Review of the Literature

1. Introduction

This literature review examines research relevant to digital technology, collaboration and innovative learning environments – within an educational context. The first section explores digital technologies and the impact they have had on learning, specifically focusing on the learning happening in our schools. Issues relating to the uptake of digital technologies in classrooms are discussed, as well as the evolving place of digital technology in the New Zealand curriculum. The second section addresses learning competencies by looking at the global attention on 21st century skills and the impact this has on education. The third section focusses on research relating to learning collaboration, defining what collaboration is, the skills it encompasses and how these can be developed in the classroom. This section also explores the use of digital technology for building learning collaboration. The final section explores designing for digitally-supported collaborative learning and includes research about task design and the impact of teacher pedagogy. It then narrows the focus to innovative learning environments and the importance of a student-centred approach to learning within these spaces. This section finishes by addressing how digitally-supported collaboration is utilised in these types of environments.

2. Digital technology in learning

The following section explores literature associated with the use of digital technology from an educational perspective. Digital technologies have changed the way we access information, communicate with others, and how we learn. The advent of the Internet, alongside the increasing portability of digital technology, means that vast amounts of information are now in the palms of our hands and accessible in almost any time and space. Warner (2006) explains that knowledge has now become a global commodity, developed and traded as a valuable product. This view of

knowledge as a commodity has led to governments across the world investing heavily in policies "aimed at encouraging adults to live, work, and learn with the support of ICTs" (Selwyn, 2006, p. iix).

Digital technologies have opened up opportunities for self-learning. There are increasing options as to what form this self-learning can take, with more people now learning through "peer-to-peer knowledge networks, collaborative networks, and aggregated private and open-source social spaces" (Davidson & Goldberg, 2012, p. 250). This increase in self-learning has also created a heightened need for society to become *digitally literate*, for people to have the skills to successfully participate in a digital world which is continually evolving. However, the term *digital literacy* is constantly changing alongside the possibilities digital technology offers, and is therefore becoming harder to define. Meyers, Erickson, and Small (2013) note that definitions now vary from basic skills such as locating and presenting information through to more participatory skills such as creating and interacting.

As the societal need for digital technology skills has increased, the expectation of schools to provide the basis of these skills has become the norm. The next section looks at how digital technology is used in classrooms and the issues surrounding its implementation.

2.1. Digital technology in the classroom

If we look back over the past 100 years of education, technology has been closely linked to education. From the early days of film projection and radio, to the mobile digital technologies of the 21st century, technology has played a role in our classrooms. Selwyn (2011) found that researchers who studied the implementation of the various technologies within education noticed a clear cycle which happened with each new wave of technology. It was noted that this *cycle* begins with a promise of the

transformative potential of the new technology. After this comes inconsistent use of the technology by teachers, followed by reasons for this inconsistent use e.g. resourcing or teacher resistance. Finally the next new technology is introduced, with the old one often pushed aside, and the cycle begins again (Selwyn, 2011).

This cyclic history of technology implementation suggests there is no guarantee that giving teachers digital technology to use in the classroom will lead to changes in learning experiences for students, rather all it does is offer the *opportunity* for change to occur (Underwood & Dillon, 2011). Research indicates that a combination of factors can lead to digital technology having a positive effect on student engagement and achievement. Simply putting digital technology into teachers or students hands, or creating a modern looking classroom environment, is not enough without thought being given to task design, assessment, school vision, teacher attitude, sustainability, pedagogical beliefs, and the educating of parents (Hayes, 2007; Livingstone, 2012; Yang, 2012).

In relation to digital technology implementation, several studies have explored reasons why some teachers are resistant to using digital technology in their classrooms and certain barriers have been noted (Ertmer, 1999; Ertmer et al., 2012; Hew & Brush, 2007; Tsai & Chai, 2012). Ertmer (1999) identified two types of barriers; first-order and second-order. First-order barriers are those that are external to the teacher such as resources, training, and support, while second-order barriers are internal e.g. pedagogical beliefs about learning, teacher confidence, and views on digital technology's educative value (Ertmer, 1999). Tsai and Chai (2012) extended this argument further suggesting that there is a third-order barrier – design thinking – arguing that "technology integration in education is not simply as a state of 'technology', rather it becomes a state of 'art'" (p. 1059).

While researchers' conclusions differ on whether internal or external barriers have the biggest impact on digital technology integration, and which should be addressed first, they agree that both types do need attending to and strategies put in place to help teachers overcome them. Hew and Brush (2007) reviewed a large number of studies into digital technology integration in schools worldwide. The study identified 123 barriers which impacted on integration. These were placed into six main categories; resources, knowledge and skills, institution, attitudes and beliefs, assessment, and subject culture. They looked at the relationships between these categories and identified various strategies to overcome them, placing these strategies into five categories:

> (a) having a shared vision and technology integration plan,
>
> (b) overcoming the scarcity of resources,
>
> (c) changing attitudes and beliefs,
>
> (d) conducting professional development,
>
> (e) reconsidering assessments.
>
> (Hew & Brush, 2007, p. 232).

New technologies, alongside the increasing global focus on preparing students for a changing society and workforce, have meant that schools have had to change their approaches to teaching and learning. Campbell, Saltmarsh, Chapman, and Drew (2013) noted that "central to these changing practices with technologies is the evolution of a reliance upon being able to work in teams, collaborating with others, drawing on fluid uses of technology and being self-directed" (p. 211). While digital technology has been used in educational settings for a number of years now, it is often in the hands of the teachers rather than the students. Research by Uluyol and Şahin (2016) suggested that student learning through digital technology is still constrained in many classrooms, noting that "a small number of teachers are the motivators and facilitators of their

students' ICT use, but most of them are users, with students as the audience" (p. 69).

There are researchers who *have* noted a positive change in digital technology use within education. A study by Schibeci et al. (2008) looked at teachers' confidence and competence in using digital technology during a digital technology development project. The project involved 12 Australian primary schools and approximately 200 teachers who were provided with professional development in the use of digital technology, curriculum development and the teaching strategies needed to support learning (Schibeci et al., 2008, p. 313). It was noted that as decisions about digital technology use became increasingly student focused, there was more of a balance between the use of digital technology and other more traditional tools such as pen and paper, and overall, the technology was being more purposefully used (Schibeci et al., 2008).

The integration of digital technology into learning environments is also affected by students. While many students are motivated by digital technology and often more willing to do tasks they may have previously avoided, this initial motivation is not necessarily enough to sustain engagement (Mills & Chandra, 2014). It is important to consider what is happening in the classroom after this initial motivation has waned and for teachers to understand that students will be at different stages in their use of digital technology - as they are in their learning. A study by Howard, Ma, and Yang (2016) used a data mining approach to explore students' confidence and engagement with digital technology, concluding that the motivation to use digital technology was closely linked to a student's ability to use the technology, and the level of challenge in the learning task. Similarly, research by Ciampa (2014) concluded that a student's motivation to engage with digital technologies in their learning was dependent on the design of the learning task, and a focus on the technical and academic needs of the individual student.

While there is not a single answer to the successful integration of digital technology, it has become apparent that several factors need to come into play for a positive impact to be observed. Chandra and Mills (2014) conducted a study looking at how 10 high school teachers integrated digital technology into their programmes. They found that the technology *was* having a positive impact on teaching and learning. However, they noted that for a positive shift to occur, several key drivers needed to be present; school leadership and teachers having a shared vision and commitment around digital technology use, the built environment enabled digital technology use, and pedagogical approaches focused on learner-centred activities. Wong, Li, Choi, and Lee (2008) also noted the importance of a shared vision between school leadership and teachers, and went on to identify that a climate of collaboration and experimentation was fundamental to the integration of digital technology into changes in teaching and learning.

The literature suggests that many factors impact on how digital technology is utilised in the classroom. Barriers need to be overcome at a range of levels (government, school leadership, teachers, students) for changes in practice to occur. Students need to be exposed to learning experiences which incorporate digital technology in an authentic manner and develop their learning competencies. The increased use of digital technologies in society and in education, has resulted in governments developing curriculum expectations around how these technologies are used, and the specific digital technology skills required of students.

The next section looks at the place of digital technologies in the New Zealand curriculum and how this has evolved over time.

2.2. Digital technologies in the New Zealand Curriculum

In 1993 Technology was identified as one of the essential learning areas in The New Zealand Curriculum Framework (Ministry of Education, 1993).

This area included digital technology (information and communication technology) and aimed to prepare students to fully participate in an increasingly technology-driven society, develop students who could make informed decisions about technology, and to enable innovative practice (Ministry of Education, 1995). Prior to the development of the current New Zealand Curriculum, learning areas each had their own document, and in the case of some – including technology, several supporting documents. Information and communication technology was listed as one of the areas in which students could conduct their technological activities, and had its own document which offered teachers ideas for developing learning activities.

A review of the curriculum took place during 2000 – 2002 and a decision was made to revise it in keeping with rapid pace of societal changes happening in the world (Ministry of Education, 2016). In 2007 the new curriculum was introduced and Technology was still one of the learning areas - including an information and communication technology aspect. However, information and communication technology was also recognised within the Key Competencies (which are discussed in the following section). The competencies are viewed as essential elements to learning in all areas, therefore the inclusion of information and communication technology within *Using language, symbols, and texts* highlights its increased presence in education.

The New Zealand curriculum is to receive its first change since being introduced in 2007 with the addition of digital technology to the learning area of Technology (Ministry of Education, 2017). This change to the curriculum covers concepts such as computational thinking, and designing and developing digital outcomes, and will be fully integrated into the New Zealand Curriculum and Te Marautanga o Aotearoa in 2018.

Our curriculum aims to develop learning competencies in students, including the ability to use digital technology, which they will be able to utilise in study, work and in everyday life in order to reach their potential (Ministry of Education, 2016). The following section addresses the building of such learning competencies – specifically looking at the global attention on 21st century skills and the impact this has on education.

3. Building learning competencies

This section is focussed on literature relating to building the learning competencies required for life in a rapidly evolving world. *Twenty-first century skills* is a term given to the competencies required of people in today's ever changing workforce. It encompasses not only interpersonal and cognitive skills but also has a growing emphasis on intrapersonal skills, as workers are expected to have complex communication skills and be able to work effectively in a team setting (Cho, 2015; Trilling & Fadel, 2009). These skills include; creativity, problem solving, information literacy, communication and collaboration, cross-cultural understanding, computing and digital technology literacy, critical thinking, leadership, adaptability, initiative, curiosity, and self-directed learning (Benade, Gardner, Teschers, & Gibbons, 2014; Cho, 2015; Ertmer et al., 2012; Genlott & Grönlund, 2016; Kaplan, 2014; Resta & Laferrière, 2015; Trilling & Fadel, 2009).

While there has been a recognised need for these skills over many years, the advancement of digital technology has seen those needs increase on a large scale as many countries shift from a manufacturing based economy to one based on services (Sanderson, 2015; Soulé & Warrick, 2015). Soulé and Warrick (2015) noted that the service based economies are "driven by information, knowledge, innovation, and creativity" (p. 179) which has changed both the daily work that takes place in business - as well as how they function as a whole. The changing face of business and the skills required for success within this has had an impact on the

education sector as we seek to enable students to become active and valued members of an ever-changing world.

According to Istance (2010), developing lifelong learners who are creative and innovative in their thinking is not necessarily encouraged in schools that function with more traditional approaches to teaching and learning. Research by Polesel, Rice, and Dulfer (2014) and Roberts-Holmes (2015) suggested this may be due to the expectations around how a school is deemed to be successful - which have become increasingly linked to the academic results of national testing schemes such as National Assessment Program – Literacy and Numeracy (NAPLAN) in Australia (Polesel et al., 2014), and English Early Years Foundation Stage (EYFS) in England (Roberts-Holmes, 2015). This conflict between the traditional and modern is an ongoing issue and one which needs addressing if change is to occur. As suggested by Soulé and Warrick (2015), many communities need to shift their thinking from their own traditional experiences of education and redefine what the true purpose of school is.

Additionally, the global move towards recognising the importance of these skills has implications for teachers. As noted by Benade et al. (2014); Trilling and Fadel (2009) and Claxton (2002), teachers themselves will need to model these 21st century skills, to be seen as experts, and to work with other professionals, creating and sharing their ideas for the betterment of their students. However, this will require changes in pedagogy, professional development, digital competencies, curriculum, assessment, and in a school's physical environment (Benade et al., 2014; Claxton, 2002; Trilling & Fadel, 2009). Education must prepare students for success in this changing workforce by giving them opportunities to develop the required skills, as well as the ability to be flexible with their use of them (Claxton, 2002). An ongoing challenge in doing this is an education system which has for many years functioned on preparing students for life in the industrial age, with many deeply ingrained beliefs about what education looks, sounds and feels like.

While still important, the traditional focus on the *3 Rs* (reading, writing, arithmetic) is no longer enough for students to prosper in today's *knowledge age* workplaces, instead they must be combined with the more complex skills listed in the previous section (Keane, Keane, & Blicblau, 2016; Trilling & Fadel, 2009). Although there are national testing schemes that appear to narrow the assessment of curricula, there is also a movement in some countries towards reforming education systems to include 21st century skills, e.g. Singapore and Israel (Organisation for Economic Co-operation and Development, 2013b). In line with these changes the Programme for International Student Assessment (Pisa) began testing children's collaborative problem solving skills in 2015 (Organisation for Economic Co-operation and Development, 2013b).

To better prepare New Zealand students for success and to develop lifelong learning skills, the New Zealand curriculum document includes the *Key Competencies* (Ministry of Education, 2007). These competencies are seen as being key to learning across all curriculum areas, complex, influenced by each other, requiring action, and developed over time. The competencies were drawn from work carried about by the OECD's DeSeCo Project (Organisation for Economic Co-operation and Development, 2005). This project brought together expert and stakeholder opinions on what competencies were key to people managing the challenges of modern life, and created a conceptual framework around this for education systems to utilise.

The key competencies in the New Zealand curriculum include: Thinking; Using language, symbols, and texts; Managing self; Participating and contributing; and Relating to others (Ministry of Education, 2007). The competency of *Thinking* relates to a student's ability to be both a creative and critical thinker, as well as being reflective of their own and others ideas. *Using language, symbols, and texts* is focussed on making meaning, and communicating meaning to others. *Managing self* is associated with students having agency over their learning, including

setting goals and overcoming learning challenges. The competency of *Participating and contributing* is about students becoming actively involved in their communities and contributing to these in an appropriate manner. *Relating to others* encompasses the following skills; being able to work effectively with others, listening actively, sharing and creating new ideas with others (Ministry of Education, 2007). Learning is not seen as a passive act but rather one that the students are actively involved in, where they understand the learning process, are reflective, and learn from and with others.

The literature summarised above indicates that the skills people require to become active and contributing members of society, are changing. Our education systems must respond to this need and while literacy and numeracy skills are still important, they are no longer enough on their own. There is a greater emphasis on the ability for students to think creatively, problem-solve, and work with others. Developing these skills in our students requires changes to the traditional concept of education at government, school, and teacher levels. These changes include increasing our understanding of how people learn in a social context, and what this looks like in practice. The next section builds on the concept of students working well with others. It focusses on research about defining what collaboration is, building learning collaboration, the skills encompassed in this and how these can be developed in the classroom, and the collaborative use of digital technology in education.

4. Building learning collaboration

This section defines collaboration and its importance within education, and also aims to highlight the differences between collaboration and cooperation.

4.1. Collaboration and cooperation

Collaboration is defined as individuals working together, discussing issues and accommodating differences in order to create *shared knowledge and understanding*; interdependence is key here, everyone has a role to play and no one individual is responsible for completing any specific element of the task (Cho, 2015; Correia, 2015; McDougall, 2010). Cooperation on the other hand, is described as individuals working together on a task with the aim of combining their separate skills and knowledge to create an end product – "cooperative work is accomplished by the division of labour among participants" (Roschelle & Teasley, 1995, p.70).

Cooperative tasks, according to Kozar (2010), are often easier for students to take part in because of the individual elements involved. It is relatively easy and familiar for students to work on an individual piece of the puzzle which can be brought back together at the end. Collaboration on the other hand can be challenging, with more emotional and cognitive demands placed on participants with students needing to be explicitly taught how to collaborate with others, and to negotiate and respect different points of view (Davidsen & Vanderlinde, 2016). Among the complex skills listed in the section above, the Programme for International Student Assessment (PISA), the Organisation for Economic Co-operation and Development (OECD) and other international organisations around the world, listed collaboration as one of the most desired (Cho, 2015; Davidsen & Vanderlinde, 2016).

Effective collaboration encompasses a wide range of skills. Group members should be able to exchange their ideas clearly, respect different points of view, encourage discussion, negotiate, listen to others, display tolerance, and manage projects (Cho, 2015; Cole & Stanton, 2003). According to Correia (2015), collaboration also requires interconnectedness, development of trust, consensus building, respect, and the clarifying of roles. The importance of roles is also noted by

Kaplan (2014) who argues that “individuals’ roles change in a group dependent on time, materials, members, and objectives” (p. 261).

Collaboration has become a worldwide life skill that is increasingly needed by people of all ages as we now live and work in environments that demand increased collaborative interactions. Correia (2015) noted that effective collaboration builds social competencies, positive relationships, and communication skills, with education seen as an important means of equipping students with these skills. The word *collaboration* is itself now commonly used in education, however, according to Cho (2015) its meaning is often misunderstood, misused, and used interchangeably with other terms such as co-operation. This highlights the importance of schools establishing a clearly defined understanding of what collaboration means to them so that this confusion between the terms is avoided.

4.2. Collaborative skills in the classroom

While it is important to have a clear understanding of what collaboration is, it is also vital to understand how to develop the skills of collaboration in teaching and learning. Roschelle and Teasley (1995) noted that being *told* to collaborate is not enough, students need to be taught how to do so successfully and, according to Davidsen (2010), this in turn requires careful preplanning by teachers. There is also a clear distinction between encouraging collaboration and actually facilitating it, with the later requiring school leaders and teachers to put in more effort to actively teach the specific skills needed, and, in turn, leading to greater collaborative results (Cicconi, 2014).

A study by Davidsen and Vanderlinde (2016), which looked at the collaborative interactions of 41 young children and three teachers in Denmark, found that there had been no structured discussion between teachers and students on *how* to collaborate, instead it appeared that the

students had to work out what *collaborate* meant, as they worked through the given tasks. It was also noted that the students could have completed many of the tasks by themselves and that these tasks were not set up to require collaboration, instead the students were "compelled to find a method for organising their collaboration" (Davidsen & Vanderlinde, 2016, p. 589). They concluded that collaborative learning requires much more than just telling students to collaborate. Teachers are required to understand the different elements of collaboration, design effective tasks, and make sure that themselves and their students not only know *how* to collaborate, but also know *why* they should (Davidsen & Vanderlinde, 2016).

Support is needed to ensure that teachers and students are able to collaborate effectively. The literature suggests that while teachers are aware of the benefits of collaboration and are eager to incorporate this strategy into their practice, it can be an unclear concept for them, and they are often unsure how to do so effectively or authentically (Cho, 2015; Fisher et al., 2013; Scalise, 2016). It cannot be assumed that students and teachers have the skills needed to collaborate and more pedagogical support on how to design effective collaborative tasks in classrooms is needed (Niemi & Multisilta, 2015). Lui (2015) also highlighted the importance of support systems but looked at this from a government level arguing that teacher training in competencies such as collaboration is essential at all levels of education.

Building collaborative skills also permeates into the wider school environment, where a strong collaborative culture will support teachers to meet their own professional needs as well as the learning needs of their students (Wong et al., 2008). In an exploratory study looking at teacher collaboration across seven different primary schools, Doppenberg, Bakx, and den Brok (2012) found that the setting in which collaboration takes place has a strong impact on outcomes. The environment was also

identified as an important factor in successful collaboration in research carried out by Bakkenes, Vermunt, and Wubbels (2010). They suggested that teacher collaboration in more formalised settings - alongside support from leadership - leads to better outcomes for teachers and in turn, students.

This section defined collaboration and its importance within education, and also noted the differences between collaboration and cooperation. The literature highlighted that the increasingly collaborative nature of teaching and learning needs further research if effective strategies and support systems are to be put in place. A clear understanding of what is currently happening in our schools will drive the changes that are required. By focussing on schools and classrooms that have a strong focus on collaborative practice, this research aims to establish some key findings to share with other educators. The next section discusses the collaborative use of digital technology in teaching and learning.

4.3. Collaboration and digital technology

While digital technologies have become relatively common place in schools, they can still be viewed with apprehension by some teachers who are unsure of how to best utilise them, often due to their own lack of digital capabilities (Dawes, 2000; Mills & Chandra, 2014), or a lack of regular, structured and personalised professional development (Hayes, 2007; Schibeci, Kissane, MacCallum, Cumming-Potvin, Durrant, & Miller, E., 2008). Adding to this uncertainty, is how to do so with collaboration in mind. Higgins et al. (2011) suggested that this uncertainty may in part be due to very few studies having been carried out on digital technology's ability to enable children's collaborative learning in classrooms.

PISA and other international organisations have noted collaboration as a key skill required in the 21st century. Alongside this skill, they also stress

the important role of digital technology and the need to use this in a collaborative manner (Organisation for Economic Co-operation and Development, 2013b). It is worth noting that although the use of digital technology in our schools has been well studied, there has not been a strong research focus on how these digital technologies are being used to support collaborative practice in the classroom (Davidsen & Vanderlinde, 2016; Higgins et al., 2011).

Digital technology use in schools is varied and largely dependent on the individual teacher and the wider school environment. A study by Smeets (2005) investigated the characteristics of learning environments and looked at how digital technology was being used within these. A survey was conducted which showed that while many teachers utilised digital technology into their classroom practice, this often had a strong focus on traditional skills-based learning rather than on tasks that encouraged creativity and collaboration. In line with these findings, Selwyn (2009) found that the use of digital technologies in classrooms can often become a passive action - a means of gaining knowledge, rather than creating original content, and that true collaboration in these settings is often an illusion. Furthermore, Adams (2011) also described digital technology in schools as often being used in a traditional sense, as a means to impart knowledge from *teacher-to-student*. It was also noted that as the adoption of digital technology is often not questioned in today's education systems due to its ubiquitous presence, neither is *how* it is being utilised (Adams, 2011).

In terms of digitally-supported collaboration, literature suggests that establishing a strong classroom culture of collaboration is an important prerequisite to success. In a project which explored how digital technology supports interactivity in teaching, Beauchamp and Kennewell (2008) concluded that "the depth of interactivity, both with and without ICT, depended very much on the richness of the task and the culture of

collaboration in the classroom" (p. 309). In addition, McCormick (2004) noted that a class needs to have a well-established culture of collaboration in regards to non-digital work first in order for digital technology to make a real impact. Furthermore, Resta and Laferrière (2015) emphasised that while the use of digital technology has become fundamental in education, certain conditions must apply for its successful implementation, including "sufficient time devoted to collaborative learning" (p. 5). These findings highlight the need for building a strong culture of learning collaboration, and giving thought to task design ahead of introducing new technologies to students.

It is important to note that while collaboration and digital technology can have a positive impact on teaching and learning, both are influenced by other factors and are not a stand-alone answer to improving outcomes. Hattie's (2009) meta-analyses of more than 800 studies showed that both teaching strategies and computers *can* have an influence on the learning environment. Hattie noted that the while the use of computers in classrooms enhanced students' engagement and attitudes to school, other factors were also required for further impact on learning. His investigations showed that the effectiveness of computers is influenced by: (a) teaching strategies; (b) teacher in-service training; (c) variety in classroom activities; (d) student-centred learning; and (e) enhanced peer-learning opportunities. In other words, digital technology on its own is not going to have a significant impact on learning - instead it must be meaningfully integrated with other factors.

Falloon (2015) commented that studies spanning many years have pointed to the potential of digital technologies for supporting collaboration between learners and teachers, both in distance education and conventional classroom contexts. His findings suggest it is important for teachers to be aware of this potential and carefully plan collaborative learning tasks which best exploit what digital technology has to offer and

have authentic outcomes for learners. This view is supported by Mills (2014), who argues that digital devices offer teachers the ability to move away from traditional classroom programmes and design a more authentic, collaborative, and reflective learning environment for their students.

The use of digital technology to transfer knowledge from the teacher to the student is being challenged. This previously narrow and individualised use has shifted, it is now viewed as an enabler of collaborative learning and this is where the focus should lie (Cicconi, 2014). Teachers should be creating meaningful and authentic learning opportunities where students use digital technology "in the same ways, and for the same purposes, that professionals do – that is, to communicate, collaborate, and solve problems" (Ertmer et al., 2012, p. 424). Advancements in mobile and cloud-based technologies open up new opportunities to support this move to a more collaborative learning environment.

The introduction of mobile technologies and cloud-based systems have also led to changes in the *when* and *where* of learning. Where *traditional* education is often directly tied to the physical classroom, mobile devices and cloud-based systems have broken down the walls of the classroom, potentially allowing learning and collaboration to happen anywhere and anytime (Armstrong, 2014; Mills, 2014; Sirkemaa, 2014). Mills (2014) also noted the ability this gives to teachers to choose to participate in meaningful learning conversations with students outside of the standard school day. This does however raise the issue of finding the balance between a teachers' personal and professional life, of learning when to *switch off* from work and also ensuring students are aware of this.

The findings from literature in this section emphasised the need for more research into the collaborative use of digital technologies. Digital technology clearly has the means to enable collaboration, however, the

skills of collaboration need to be deliberately taught before a real impact on learning can be achieved. Teaching and learning have been strongly influenced by the collaborative use of digital technology, particularly regarding where and when this can take place – potentially turning the traditional classroom *on its head*. The following section explores designing for digitally-supported collaborative learning. It discusses the importance of effective task design, and the impact teacher pedagogy has on digital technology use. This section then focusses on defining innovative learning environments, the learning that can occur in these types of spaces, and how digital technologies are utilised in these environments.

5. Designing for digitally supported collaborative learning

This final section explores research in the area of digitally-supported collaborative learning, including task design and teacher pedagogy. The section also includes consideration of this concept in relation to innovative learning environments.

5.1. Task design

Incorporating digital technology into the classroom environment in order to enable collaboration requires the learning to be purposefully designed or selected (Cho, 2015), in order to evoke the desired collaborative behaviours (Holliman & Scanlon, 2006). The level of interactivity between students – regardless of digital technology use - depends on the collaborative culture that has been established in the classroom, as well as the "richness of the task" (Beauchamp & Kennewell, 2008, p. 309). This suggests that the initial focus around task design should be on the students and their learning - rather than the technology. Mills (2014) agrees, pointing out that given the wide range of digital technology available, educators need to carefully consider how the tool (technology) best meets the needs of the learning task and the students, additionally noting that the technology does not necessarily need to be utilised at

every stage of the activity, but only where it might “expedite or simplify a task” (p. 52).

It is suggested by McCormick (2004) that much of the literature on collaboration focuses on outcomes rather than the nature of the task itself, “i.e. the need for the task to enable or even require collaborative activity” (McCormick, 2004, p. 165). Additionally, McCormick (2004) noted that learning tasks are often cooperative, with students helping each other *at times* but producing individual outcomes, rather than being collaborative. It is therefore essential to consider the authenticity of the task, whether it will provide students with a challenge that they will have to work through *together* in order to reach the desired outcome. This focus on the conditions which enable collaboration is highlighted by Resta and Laferrière (2015) who recognised the need for authentic task design but also for the tasks to provide opportunities for a wide range of interactions. Also of importance is considering assessment methods, which will enable students to recognise and evaluate their own and their peers’ contributions to the product or outcome of a task (Holliman & Scanlon, 2006; Resta & Laferrière, 2015; Scalise, 2016).

In relation to task design, it is also important to consider the design and use of the digital technology itself. Cole and Stanton (2003) reviewed three projects which aimed to support collaboration through digital technology use. Primary data came from video recordings alongside notes from direct observations. Their findings indicated that if the digital technology was specifically designed to support and enable collaboration in learning, then it would do so. Furthermore, Cole and Stanton (2003) noted that “with an inappropriate design, a mobile interface may equally prove to be a barrier to learning” (p. 366). The physical design of a device can also be a possible barrier to collaboration, with devices which can be used simultaneously by multiple students facilitating collaboration more effectively than those that are limited to individual use (Fisher et al., 2013). It is important then for educators to be strategic about digital technology

use - to choose the best tool for the task, rather than using the technology just because it is available.

Research on the design of learning tasks tells us that the focus should be on the students, on their learning needs and how digital technology can provide support for this. The design of learning tasks is ultimately in the teachers' hands and therefore influenced by their own pedagogical beliefs. The following section discusses this in more detail, looking at the impact pedagogical beliefs have on the collaborative use of digital technology.

5.2. Impact of pedagogical beliefs

The pedagogical beliefs of teachers are central to how digital technology is used for supporting teaching and learning in the classroom (Prestridge, 2012; Resta & Laferrière, 2015). Successful teaching and learning involving digitally-supported collaboration requires teachers to have clear alignment between their pedagogical beliefs and their practice. Studies have shown that merely incorporating digital technologies into classrooms is not a guarantee of practice changing, rather it can result in the technology being used to support traditional practice rather than transforming learning (Ertmer et al., 2012; Fahser-Herro & Steinkuehler, 2010; Wong et al., 2008).

A multiple case-study research project carried out by Ertmer et al. (2012) looked at the alignment of teachers pedagogical beliefs and their digital technology practices. Teachers were selected who were already considered leaders in the educative use of digital technology. Data from the analysis of teachers' websites were collected and compared to data from one-on-one interviews to examine how these results corresponded to each other. Ertmer et al. (2012) found that the results showed a close alignment between pedagogy and practice, suggesting that teachers with strong beliefs around student-centred practices, including collaboration, "tended to enact student-centred curricula despite technological,

administrative, or assessment barriers"(p. 423). This study does not, however, involve observing the teachers in practice – with the researchers acknowledging this as a limitation of the study, along with the small sample size and teacher selection (Ertmer et al., 2012).

The literature related to teacher pedagogy suggests that there needs to be an alignment between teachers' beliefs and their practice in order for digitally supported collaboration to impact on learning. The next section narrows the focus of this chapter to research related to innovative learning environments, including the physical make up of these, and how collaboration and digital technology are utilised within them.

5.3. Innovative learning environments

While the literature suggests that there are some positive changes occurring in the way digital technology is being utilised in teaching and learning practices, Mercier, Higgins, and Joyce-Gibbons (2014) noted that the focus must also fall on the environment, arguing that digital technology has, in many cases, not met its potential to change the learning environment. They suggest that "one possible explanation for this is the need, not just to design the technology to support the learning experiences of each child, but also to redesign the classroom environment in which the technology is used" (Mercier et al., 2014, p. 504). The physical classroom environment and the design of the learning that happens in this, along with the integration of digital technology must be deliberately planned in order to enable collaboration and optimise learning.

Innovative learning environments (ILEs), modern learning environments (MLEs), and flexible learning spaces (FLSs) are just some of the terms used to describe the current changes happening to the physical environment of our schools, as well as to the learning taking place within these. The physical environment encompasses such concepts as

moveable classroom walls, covered decks, acoustics, lighting, mobile furniture, and a range of furniture styles. The learning that occurs in these environments is the main focus of this section, but, as will be discussed, is closely connected to the physical. Given the range of terms for these environments, for the purpose of this study I will be using the term *innovative learning environment (ILE)* to avoid confusion.

The traditional classroom setting was designed with one-way learning in mind – from teacher-to-student. Innovative learning environments on the other hand are designed for more flexibility in both their physical nature as well as in approaches to teaching and learning, including interactions with digital technology (Imms, 2016; Neill & Etheridge, 2008; Saltmarsh, Chapman, Campbell, & Drew, 2015; Trilling & Fadel, 2009). The features of these environments are relatively new to education, aside from a short time in the mid 70's with the open plan movement (Imms, 2016). As Armstrong (2014) noted, a learning environment "may be understood to be the complete physical, social and pedagogical context in which learning is intended to occur" (p. 9), but additionally, an *innovative* learning environment also is reflective of current pedagogical thinking and practice. Furthermore, according to Campbell et al. (2013), they can disrupt traditional teaching and learning methods, exposing teacher practice and removing the physical and mental barriers of teachers working together collaboratively.

Neill and Etheridge (2008) describe a project studying the impact a flexible learning space could have on teaching and learning, looking at both the teachers' and students' perspectives. An environment was purposefully created combining the physical classroom space with digital technology in order to support a wide range of teaching and learning experiences. Surveys of teaching staff and students were conducted which included scaled response questions as well as open-ended options. Personal interviews were also carried out. Neill and Etheridge (2008) indicated that the flexible space increased "student engagement, collaboration, flexibility,

and learning" (p. 47), but was dependent on the pedagogical approached used by teachers - with a student-centred approach having more impact.

Saltmarsh et al. (2015) suggested that this student-centred approach is a natural fit with, and an expected outcome of, innovative learning environments and the collaborative teaching and learning that takes place within these. ILEs need to be flexible spaces where all students are encouraged to take responsibility for their own learning. These spaces should develop students who see themselves as decision makers (Willis, 2014), as valued members of their learning spaces who collaborate with others, help each other to learn, and who utilise both formal and informal settings in their learning (Ciampa, 2014; Niemi & Multisilta, 2015).

Classrooms that have developed a strong student-centred approach to learning are backed by teachers and school leaders who have a shared vision around how learning happens (Organisation for Economic Co-operation and Development, 2013a; Wong et al., 2008). A study by Wong et al. (2008) looked at the relationship between technological innovations and pedagogical innovations across eight schools in Hong Kong and Singapore. Results showed that the schools that had adopted student-centred approaches, generally had teachers and leadership who had a shared vison around inquiry learning and collaborative practice as well as the use of digital technology to support learning (Wong et al., 2008). Additionally, it is important to note that a focus on student-centeredness does not diminish the role of the teacher. Student-centred innovative learning environments actually require teaching professionals to be highly committed to shaping effective, inclusive learning opportunities by selecting the most appropriate teaching and learning strategies for their students (Istance, 2010; Prestridge, 2012).

A student-centred approach is not only central to the teaching and learning that takes place in ILE's, it can also have a role to play in the development and set up of these spaces. In a case study of a school leader in Australia

who invited a teacher and her students to design their own learning space, Willis (2014) found that both student and teacher thinking had shifted in terms of learner responsibility, with students taking more control in this area. It was also noted that the design of the learning space related to both the physical *and* relational space. Focusing on just one of these elements was not enough and for transformation to occur, ongoing support for the teachers and students working in these spaces was essential (Willis, 2014). Further research is needed to understand how these spaces are being used by both teachers and students, and how the physical and relational environments are being constructed to develop 21st century skills (Campbell et al., 2013; Saltmarsh et al., 2015).

Teaching and learning that is student-centred, collaborative in nature, encourages active participation and values experimentation, requires an innovative, flexible learning space - but the changed space alone will not result in pedagogical change (Bradbeer, 2016; Mulcahy, Cleveland, & Aberton, 2015; Neill & Etheridge, 2008). The challenge for school leaders is to not only focus on the physical design of these new learning spaces but to also grow their teachers' understandings around the *use* of these environments through ongoing professional development opportunities (Campbell et al., 2013). Bradbeer (2016) adds another level to this thinking, noting that research is calling for a clearer understanding of how teachers occupy these spaces, looking at what actually works in practice, and in terms of collaborative teaching teams, "what works *together*?"(p. 75). Mulcahy et al. (2015) suggested viewing the term *learning spaces* as "a verb rather than a noun, that is, as something we do (a matter of encounter), rather than something we have (a new learning environment, a finished design)"(p. 590).

According to the Organisation for Economic Co-operation and Development, there are seven key principles needed for innovative learning environments to be most effective – all of which should be met.

These are:

- Make learning and engagement central;
- Ensure that learning is social and often collaborative;
- Be highly attuned to learner motivations and emotions;
- Be acutely sensitive to individual differences;
- Be demanding for each learner but without excessive overload;
- Use assessments consistent with learning aims, with strong emphasis on formative feedback;
- Promote horizontal connectedness across activities and subjects, in and out of school.

(Organisation for Economic Co-operation and Development, 2013a, p. 12).

The principles are based on learning research findings reviewed by educational researchers and learning specialists, and can be used as criteria by schools as they develop their own learning spaces. While all principles should be met for an innovative learning environment to be most productive, how they actualise is dependent on the individual interpretations of each school community (Organisation for Economic Co-operation and Development, 2013a).

The literature summarised above regarding innovative learning environments indicates that there is a world-wide change occurring in how learning spaces are being designed and used. A student-centred approach appears to be a natural fit with these environments, with research showing increased student engagement and motivation to learn. There is, however, a recognised need for more research into how these spaces are actually being used by both the teachers and the students.

The next section expands on the concept of innovative learning environments, looking at how digital technologies are utilised within these to enable and support collaborative teaching and learning.

5.4. Promoting digitally supported collaboration in innovative learning environments

As mentioned in an earlier section, simply using technology does not guarantee that learning (including collaborative) will occur – the physical environment also plays an important role. Dillenbourg and Jermann (2010) talk about orchestrating the "physicality" of the classroom to best utilise the technologies available in these spaces. This is even more applicable today given the growth of mobile digital technologies and the flexibility these offer to the design of activities and the interactions able to take place (Trilling & Fadel, 2009). In other words, the physical environment needs to allow teachers and learners to move easily around the spaces as required, it should be designed to ease collaboration and should allow the available digital technology to be used in a manner which suits the needs of participants.

Educational needs are shifting away from what the traditional classroom model can provide, and as this occurs, teachers and learners must acknowledge the new collaborative possibilities that digital technology allows for. As noted by Resta and Laferrière (2015), this shift "raises the bar of what is expected of teachers and learners" (p. 5), meaning that both parties need to be skilled in both how to work alongside others and how to best utilise digital technology. This will often require specific training in these areas as a desire to use digital technology in a collaborative manner must be supported by the skills to do so. A recent study by Swallow (2015) explored the experiences of students and teachers in a 1:1 iPad environment, finding that while teachers had ambitions of creating new ways to teach students, their limited understanding of how to use digital technologies in a modern learning environment led to more teacher

control, less student involvement in the learning process and less collaborative tasks being given to students.

The need for school communities to work together to develop innovative learning environments that utilise digital technology and collaborative practice is influenced by current pedagogical beliefs, but in New Zealand, it is also driven by government priorities. The New Zealand Ministry of Education's 2014-2018 Statement of Intent (Ministry of Education, 2014) highlights the priorities of our government for our education system, including the growing need for collaboration, digital technologies and modern learning environments. Relevant sections are summarised in Table 1.

Table 1. New Zealand Ministry of Education priorities.

Priority 1: Raise teaching quality and leadership	**Priority 2: Create a modern learning environment**
This priority highlights the Ministry's investment in teachers' professional learning and development, signalling the link between high quality teaching professionals and their ability to meet the needs of all students. This priority also discusses the need for improved and extended professional collaboration, which relates directly to the focus of this research (Ministry of Education, 2014 – 2018, p.18).	The potential of digital technologies and modern learning environments to help equip students with specific skills is a clear goal in this section (Ministry of Education, 2014 – 2018, p. 22). Modern learning environments are about much more than the physical environment; they involve the blending of multiple factors including technology, formative assessment, inquiry based approaches, task design, and keeping the learner at the centre of the learning process (OECD, 2013).

As more schools in New Zealand move towards meeting these priorities through developing digitally-supported innovative learning environments,

there is an increasing need for teachers to be working together, sharing and creating new knowledge and collaborating in a manner which is new to many of them. There needs to be clarity of purpose across the whole learning community regarding these spaces, including students, teachers, leadership, and parents. Lippman (2015, p. 39) suggests that school communities make time to discuss the following questions before developing these environments:

- Why create collaborative spaces?
- What spaces are appropriate for collaborative activities?
- What forms do collaborative spaces take?
- Can these spaces be created apart from the social matrix of the environment?
- Are these spaces the same in all learning environments, or are they culturally and contextually defined?
- How is information technology integrated?
- Are these spaces sustainable over time?

(Lippman, 2015, p. 39)

Asking questions such as the ones above will assist school communities to come to a shared understanding of what a digitally supported, collaborative learning environment should and could look, sound and feel like for them.

6. Summary

This research explores the role digital technology might play in collaborative practice within innovative learning environments. The literature reviewed in this chapter has highlighted the need for more research in the area of innovative learning environments and how schools

make the changes necessary to move into these spaces. Literature also suggested that while there is substantial research around the use of digital technology in education, there is a gap regarding its collaborative use within innovative learning environments.

Research indicated that there is a need to observe teachers and students in their own environment, looking at how they are currently using digital technology to enable collaboration. It is also clear that the development of a shared understanding within a school community is important here, with regard to what collaboration looks like in practice, the purpose of digital technology, and the development of innovative learning environments. Finally, the literature identified a need for change in the education sector, not only in the physical classroom environment but also in the teaching and learning practices that take place in them. In essence, digital technology use, along with the design of our learning environments, needs to be in-line with current pedagogy, and matched with the shift from teacher-centred to student-centred practices. (Bradbeer, 2016; Keane et al., 2016).

The following chapter outlines the research design of this study and includes the theoretical framework underpinning this and the research process involved.

Chapter Three: Research Design

This section describes the research design of this study. It begins with a brief introduction to educational research and revisits the research question. Following this is a description of the theoretical framework of the study including: the ontology, epistemology, research paradigm, methodology and data collection methods utilised. Next, the research process is discussed, covering participant selection, ethical considerations, data gathering and analysis, and how trustworthiness and authenticity were maintained.

1. What is educational research?

Mutch (2013) defines research as a systematic investigation that "gathers data in order to solve a problem, illuminate a situation, or add to our knowledge" (p. 20). According to Creswell (2012, pp. 4-6), the importance of *educational* research lies in the following: research adds to our knowledge, research improves practice, and research informs policy. In other words, importance is placed on the research having impact - whether that is within a specific educational setting or the wider education sector. Menter, Elliot, Hulme, Lewin, and Lowden (2011) also highlighted the importance of impact and shared three key elements in undertaking educational research. These elements are; *enquiry* – attempting to develop new knowledge, *systematic* – the enquiry needs order and to be defensible, and *sharing outcomes* – sharing findings shifts an activity from a personal enquiry to research (Menter et al., 2011, p. 3).

This study aims to encompass these three elements and have an impact on teacher knowledge and practice. With regard to the element of *enquiry*, this study is attempting to develop new knowledge through exploring students' and teachers' perceptions of collaboration, and the role digital technology might play in collaborative practice, in particular, within innovative learning environments. The second element – *systematic* – is

reflected through this entire research process, from the initial proposal through to the publishing of this thesis. To achieve order and be defensible, this study includes: a review of relevant literature; an explanation of the methodology underpinning the research - as well the data collection methods used; a description of the findings; a discussion of the meaning and implications of those findings; and a concluding statement which states the significance of the findings and recommendations for future research. Finally, the element of *sharing outcomes* will be obtained through the sharing of results within and beyond the publishing of this thesis.

2. Research Question:

As discussed in the introduction section the aim of this research is:

To explore principles underpinning the development of collaborative learning environments in three primary schools, and any role digital technologies play in establishing and sustaining these.

The questions underpinning this aim are:

1. What are teachers' and students' understandings of collaboration, and how is this established in their classrooms?

2. Do teachers and students consider digital technology plays a role in establishing and sustaining this collaboration, and if so, how?

3. How do teachers and students consider digital technology-supported collaboration influences teaching and learning in their classrooms?

3. Theoretical Framework

3.1. Ontology

Ontology is the study of how people view the world and what they perceive to be real (Cohen, Manion, & Morrison, 2011). This view of how the world exists and the place of humans within it can range from being seen as very fixed and independent of individual people, or by contrast, very fluid and socially constructed (Bartlett & Burton, 2012; Bryman, 2016; Mertens,

2010). Two contrasting social ontological beliefs are objectivism and constructionism. Objectivists believe that one reality exists and that there are fixed facts about society that are independent of people, whereas constructionists hold the view that there are multiple realities and they are socially constructed (Bartlett & Burton, 2012; Bryman, 2016; Mertens, 2010).

I hold a constructionist position, assuming that reality has many layers, is complex, open to different perspectives and interpretations, and that people actively construct and reconstruct their own subjective view of reality (Bryman, 2016; Mertens, 2010). As a constructionist researcher, I am interested in the important concepts of a study emerging from the participants, constructed by their own interpretations of *their* experiences (Mertens, 2010).

This view of reality being socially constructed leads naturally to my epistemological view of knowledge being created through social interactions, and had an influence on the research methods adopted.

3.2. Epistemology: Sociocultural

Epistemology is our belief about the nature of knowledge and how this is constructed and communicated to others (Cohen et al., 2011). Our epistemology is closely related to our ontology. How we view the world and what we see as being *real* is directly linked to how we view knowledge construction and understanding (Bartlett & Burton, 2012).

I see knowledge as being socially constructed and influenced by our cultural environments and the interactions that take place within these. This sociocultural view of knowledge development is underpinned by the works of Lev Vygotsky, who claimed that learning occurs *in a social manner* (Vygotsky, 1978). Through interacting with others within authentic learning experiences, learners guide each other towards developing a

shared knowledge and understanding - before arriving at their own individual interpretations (Cho, 2015; Davidsen & Vanderlinde, 2014; Eun, 2010).

A sociocultural epistemology places importance on dialogue, which is seen to move from the social plane to the private (intrapersonal to interpersonal) as learners make sense of new concepts (Schunk, 2008). Language is seen as being the key to the negotiation of meaning - with learners using it as a mediation tool with each other, coming to a shared understanding before they themselves internalise what they have learned (Reusser & Pauli, 2015). This study has a strong focus on the dialogue between participants and also between the researcher and participants. It aims to understand *how* collaboration takes place and to understand the participants' views on the role digital technology plays, if any, in collaboration.

3.3. Interpretive Paradigm:

A paradigm is a certain way of viewing the world and is composed of one's ontological and epistemological beliefs which in turn inform the choice of methodology and data collection methods undertaken in research (Scotland, 2012). My philosophical stance aligns with a sociocultural paradigm. I believe that our perceptions of reality and the development of our knowledge are socially constructed and influenced by culture.

This research seeks to understand how people are using digital technology to collaborate with each other. I want to gain an in-depth understanding of different people's interpretations of the role digital technology plays in collaborative practice. As a result, an interpretive paradigm was adopted for this research so I could focus on the individuals, on their experiences and "interpretations of the world around them" (Cohen et al., 2011, p. 22).

An interpretive researcher seeks to understand how our social world is created and to describe in detail, through observations in natural settings, how people make sense of this world (C. Davidson & Tolich, 2003). Radnor (2002) adds to this thinking, suggesting that the purpose of the interpretive researcher is to seek *clarification* of how these interpretations of our social world are formed and then shown through life experiences. In other words, *how* do people form their beliefs and understandings and *how* are these then shown through actions in their daily lives.

The adoption of an interpretive paradigm and a socioculturally-located epistemology has clear implications on the methodology undertaken in this study, and this will be detailed in the following section.

4. Methodology

This study was undertaken using a qualitative methodology within a collective case study framework. The interpretive paradigm underpinning this research draws a natural link to a qualitative approach in that this approach enables the researcher to explore real experiences in-depth, and to interpret and gain an understanding of people in context (Cohen et al., 2011). Qualitative researchers aim to gather rich descriptions (Mutch, 2013), to make sense of a phenomenon without placing preconceived ideas on it (Mertens, 2010), and to study the *meanings* people apply to these phenomenon (Denzin & Lincoln, 2005).

In regards to this study, a number of qualitative methods were utilised within the case studies to help gain a more in-depth understanding of collaboration and the role digital technology might play in this. Using a range of methods also assisted with the trustworthiness of my data, and enabled me to form more specific and relevant interview questions by basing these on themes arising from observations and artefacts.

4.1. Case Study

Case studies, according to Yin (2009), are a means of exploring and analysing something in-depth and from various angles, looking to understand the *how* and *why* of a phenomenon within certain boundaries (Thomas, 2011). This exploration is carried out within the phenomenon's real-life context and relies on multiple sources of evidence (Yin, 2009), which can deepen researcher understanding (Benade et al., 2014). Case study was the chosen methodology for *this* research because gaining an in-depth understanding of how individuals perceived collaboration, and how digital technology was being used in collaborative practice, required observing both teachers and students working on authentic tasks, within the boundaries of their *own* environments.

Stake (2003) identified three types of case studies: *intrinsic* – when the study focuses in on a particular intrinsic interest; *instrumental* – where the study provides insight into a secondary interest in order to develop further understanding of a primary research focus; and *collective* – when the focus is on the phenomenon being studied and is done by conducting a number of case studies. A collective case study was used in this research to better understand digital technology's role in collaborative practice across schools and across various teaching and learning partnerships.

While case studies are an effective means of looking at a phenomenon in detail within its real life context, there are potential weaknesses to this methodology which researchers need to be aware of. Yin (2009) identifies common concerns regarding case study research, these are: a lack of rigor, generalisability, and an inability to establish causal relationships. Member checking of interview transcripts, and the triangulation of data collection methods were carried out in this study, which can help achieve rigor (Denzin & Lincoln, 2005). While I have used multiple case studies which, according to Cohen et al. (2011) can increase generalisability, the small sample size means I must acknowledge this as a limitation of this study. In relation to causal relationships, this study is *not* looking to

establish what these are, rather it aims to interpret the *understandings* individuals have about collaboration and the collaborative use of digital technology. I have also taken a reflexive and reflective approach to all aspects of this research, making sure that I am constantly critiquing my decisions, interpretations, and actions.

4.1.2. Triangulation

Triangulation is defined by Bryman (2016) as "using more than one method or source of data in the study of social phenomena" (p. 386). It is used in qualitative research to corroborate findings, provide a basis for discussing variation in results, and offers the researcher more depth to their data analysis (Bartlett & Burton, 2012). Yin (2009) describes the use of *multiple sources of evidence* (triangulation) as one of the three principles of data collection in case study research alongside *creating a case study database* and *maintaining a chain of evidence*. This use of multiple sources of evidence requires researchers to be skilled in each of the data collection methods undertaken. An overreliance on one method can result in a case study turning into a different type of study, for example, an over reliance on interview data could turn a case study into simply an interview study (Yin, 2009). To avoid this, my interpretations of observations and documentation influenced the interview questions formed - meaning that answers were in part driven by these other methods.

4.1.3. Reflexivity

Reflexivity in research is "the process of reflecting critically on the self as researcher" (Denzin & Lincoln, 2005, p. 210). Cohen et al. (2011) note that reflexive researchers are "acutely aware of the ways in which their selectivity, perception, background and inductive processes and paradigms shape the research" (p. 224). Reflexivity was an ongoing process throughout this study. I was very aware and critical of decisions pertaining to all stages of the research such as: the choice of data

collection methods, wordings of interview questions, development of themes during data analysis, and my interpretations of research findings.

4.2. Data Collection Methods

A range of methods were used to collect data for this study. This enabled me to triangulate my data, ensure that all of the research questions were addressed, and that the data reflected the multiple aspects of individual's experiences and understandings. Methods are discussed below with a justification for inclusion, as well as a discussion around possible concerns arising from their use and how I mitigated these.

4.2.1. Artifacts

Artifacts can prove useful in educational research and give the researcher a visible indicator of what is happening in a classroom (Bryman, 2016). The artifacts collected in this study were in the form of photos of the classroom layout and learning activities, as well as documents such as teacher planning and student work. Artifacts were collected and analysed for evidence relating to the research questions, and were also used to help form questions for the semi-structured interviews and focus groups. This use of other methods, alongside artifacts, allows the researcher to validate or check evidence from other sources (Yin, 2009).

While artifacts can be a useful data source, according to Yin (2009) they are often easy to observe but can be open to multiple interpretations. This means that when collecting and analysing artifacts, researchers must keep in mind *who* produced the artifact, and the *purpose* of its production (Cohen et al., 2011; Hancock & Algozzine, 2011). Therefore, to assist with this, notes were recorded about each artifact, detailing this information. This interpretive challenge is also why this method of data collection was used in conjunction with observations and interviews in this study.

4.2.2. Observations

According to Mutch (2013), observations within qualitative research are used to gather rich descriptive data in the field. They allow researchers to see how people act in their own environments, to check espoused beliefs against actions, and can provide more *objective* information (Bartlett & Burton, 2012; Mutch, 2013). Observations allowed me to gather data as it occurred - to observe collaboration *in action,* rather than through second hand accounts of teachers and students. While observation is seen as a powerful data collection tool, Cohen et al (2011) stresses the importance of utilising other data gathering methods alongside observation to ensure that inferences derived from observations are reliable.

There are several issues to be aware of in relation to using observations to gather data. One issue is selectivity, that is, the researcher choosing what will be observed, with broad coverage becoming difficult without multiple observers (Yin, 2009). A further issue is that the observer may affect the natural behaviour of those being observed leading to the observed event advancing differently and yielding unreliable results (Adler & Clark, 2015; Ertmer, 1999). To address these issues it was initially important for me to be aware of them and have a clear understanding of how they could impact my data. This required me to continually be reflexive about *what* I was choosing to observe as well as *my* role in the observation process. To assist with this, I created an observation schedule (see Appendix A) based on collaborative skills identified by Sharratt and Planche (2016) and Murphy (2004). A copy of this schedule was used for each observation.

4.2.3. Semi-structured interviews

Interviews have been used as a means to collect qualitative data for many years, whereby researchers interact with participants in order to gain insights into their world and how they perceive various aspects of it (Cohen et al., 2011). Structured interviews follow a set of prescribed questions, while semi-structured interviews have a more open approach. Semi-structured interviews consist of some preformed open-ended

questions which are typically elaborated on during the interview, and which in turn may inform the development of new questions (Adler & Clark, 2015).

One of the strengths of semi-structured interviews is that while the researcher has an agenda for the topic to be explored, they are able to explore it as needed and negotiate the direction of the interview with the interviewee (Adler & Clark, 2015; Menter et al., 2011). According to Cohen et al. (2011), they also allow for the researcher to clarify interpretations made from other data sources and explore these in more depth.

While there are clear benefits to conducting semi-structured interviews there are also weaknesses that need to be considered. One weakness is due to the flexible nature of semi-structured interviews, the order of questions is changeable and this can lead to some important questions being left out (Cohen et al., 2011). As noted by Creswell (2012), another issue is the possibility of the interviewee telling the researcher what they *think* they want to hear, which can in turn be inadvertently influenced by the responses and actions of the researcher (Adler & Clark, 2015; Mertens, 2010).

My semi-structured interviews were held with teachers after artifacts had been collected and observations had taken place. This allowed me to form relevant questions and themes based on my interpretations of the artifacts and observations. Semi-structured interviews allowed me to probe deeper into any themes raised by the teachers and students, and to check my initial interpretations of artifacts and observations with them. This probing and checking can result in reducing the risk of participants giving 'socially desirable' answers instead of what they *really* think (Patton, 1990).

4.2.4. Focus groups

Focus groups interviews rely on the interaction *between* participants and are mostly used in academic research to study health, education, the environment and community issues (Krueger & Casey, 2015). The data gathered emerges *from* these interactions so is a collective view rather than individual (Cohen et al., 2011). Focus groups can give people an opportunity to discuss their thoughts about a topic and importantly, why they think that way, aiming to do so in a safe and comfortable environment (Hinds, 2000). This aim of a safe and supportive environment was an important reason for my choice of focus groups when working with the students in this study. Conducting the interviews at the students' school, alongside their peers, helped to establish a safe environment for those involved.

4.2.4.1. Focus groups involving children

When conducting focus groups with young people extra time must be given to establishing ground rules, ensuring they understand why the research is being conducted, and clearly explaining the role of the researcher (Menter et al., 2011). In terms of this study, ground rules were established and discussed immediately prior to interviews taking place – these are covered in detail in the following *research process* section. At this point, I also revisited the purpose of the research and of the interview.

Focus groups should ideally number between five and eight participants, who are familiar with each other (Menter et al., 2011), and of a similar age (Gibson, 2012). Consideration must be given to language used and the questions asked, making sure that these are age appropriate, open-ended, and understood by all (Cohen et al., 2011). Questions in this study were developed based on my observations and interpretation of collected documents to ensure they were relevant and meaningful to the students involved.

Building trust is also important - the children should be familiar with the researcher before the interview takes place and the relationship should be seen as a partnership rather than hierarchical (Gibson, 2012). Focus group interviews for this study were carried out *after* initial meetings and observations, ensuring that the children were familiar with the purpose of my research and with me.

5. Research Process

The following section describes the research process undertaken. It discusses the participants, their selection and the ethical considerations around their involvement. After this, the processes of data gathering and analysis are explained, followed by a discussion of how trustworthiness and authenticity were maintained in this research.

5.1. Participants

This research involved three schools in a newly formed community of learning, with participants from each school forming each individual case study. Schools were chosen for their innovative teaching and learning practices, including the strong use of digital technologies. The criteria for selection is discussed in the following section.

5.1.1. Criteria for participant selection

Table 2 shows the criteria given to principals and used to select possible teacher participants in each case study.

Table 2. Criteria for participant selection

Case Study 1 – teacher-to-teacher collaboration using digital tools.	**Case Study 2 – student-to-student collaboration using digital tools.**	**Case Study 3 - Teacher-to-student collaboration using digital tools.**
Teachers have been working together in a co-teaching relationship for a minimum of 6 months. Digital technology is well utilised as part of the teaching and learning process. The teachers are recognised as effective practitioners by their Principals.	Digital technology is well utilised as part of the teaching and learning process. A strong collaborative learning environment has been created, where digital technologies are used for student-to-student collaboration. Digitally-supported collaborative tasks are familiar to students - they often work alongside each other in this manner.	Digital technology is well utilised as part of the teaching and learning process. There is a history of digitally supported collaboration between the teacher and his/her students.

5.1.2. Selected participants

The participants in case study one (teacher-to-teacher) are in their second year of collaborative teaching together - with this being their only collaborative teaching experience to date. Kate has been teaching for fifteen years, with experience ranging from year two through to year seven. Tama is in his sixth year of teaching and has taught from year three to year six over this time.

The teacher participant in case study two (student-to-student), has been teaching for six years with experience from year three to year six. This is Amber's second year working in a collaborative teaching space. The students in this case study are in year five and six, ranging in age from nine years to eleven years. There are 61 students in the class but only 34 returned consent forms and could be involved in the study.

Case study three (teacher-to-student) involved a class of year four and five students ranging in age from eight years through to ten years. There were 63 students in this class, 54 returned consent forms and were able to take part in the study. The teacher participants are in their first year of collaborative teaching. Ana has been teaching for 17 years - across all primary school year levels. Emma is in her fourth year of teaching with experience from pre-school to year 6.

5.2. Ethical Considerations

Ethics are primarily about what is *right and wrong* in terms of conduct and, in relation to social research, can be complex and dependent on those involved (Thomas, 2011). The ethical considerations relating to this research included gaining access and acceptance, obtaining informed consent, and conducting insider research.

5.2.1. Access and acceptance

Gaining access to a research site and to participants is an important part of a research project and research cannot start until this is achieved (Cohen et al., 2011). As noted by Menter et al. (2011), while gaining access can be less of an issue when the researcher has a connection to the site, it is still vital to go through the expected procedures. I had professional connections to two of the schools and worked in the third, and while this certainly made approaching participants easier, formal procedures were followed. Ethical approval was granted by the University of Waikato on March 31st 2017, and access to the three school sites and potential participants was gained from their principals.

5.2.2. Informed Consent

Informed consent is a fundamental part of conducting research ethically. It involves providing potential participants with clear and concise information about the research so that they are able to make an informed and voluntary decision about their participation (Adler & Clark, 2015).

Voluntary participation is also highlighted by (Cohen et al., 2011) as a key issue to consider. Researchers need to ensure that participants do not feel under pressure to take part, “the choice on whether or not to participate must be genuinely free” (Cohen et al., 2011, p. 81).

This research required consent from the school principal, teachers, parents, and students before proceeding. Emails were sent to principals which clearly explained the research and, if they were interested, asked for names of potential participants. Discussions were held with potential teacher participants to discuss the research aim and clearly reiterated the voluntary nature of the study.

Letters were given to principals, teachers, parents, and students informing them of the research goals and the requirements of participants (see appendices B, C, D, & E). These letters also made it clear that participants had the right to withdraw from the research and that while anonymity could not be guaranteed, every effort would be made through using pseudonyms (for schools and individual participants) throughout the reporting of any data.

When research involves children, several factors need to be considered in regards to informed consent; who needs to give permission, adapting forms for young participants, student understanding of voluntary participation, and their understanding of the purpose of the research (Cohen et al., 2011; Mutch, 2013). I met with students in their classrooms to discuss the research with them, what was required of them as participants, and to answer any questions they had. The student consent form was attached to the parent information and consent form so that parents could discuss the process with their children before consent was given.

Linked to informed consent, assent was also sought from students. Assent refers to seeking an individual's willingness to participate in research, typically used when working with children (Papatheodorou, 2013). While students and their parents had filled in a consent form, it was also important to ensure the students understood they could revoke participation at any point during the study. *On-going* assent was therefore undertaken – meaning assent was "renegotiated over the life of the research" (Dockett, Perry, & Kearney, 2012, p. 804). Verbal assent was gained from all students at the beginning of focus-group interviews, and during observations. They were reminded of the research aim, my role as researcher, and that they could withdraw from the research at any time.

5.2.3. Insider research

During this research, I was on study leave from one of the participating schools and was working there one day per week as a senior release teacher. Furthermore, I was appointed as the release teacher for one of the 'teacher-to-teacher' case study participants in this research. This meant I would be working with the other teacher participant half a day per week. Humphrey (2013) suggests for insider researcher, there is a high need to be risk-aware, in an effort to avoid or at the very least lessen any potential risks, rather than simply being risk-averse. I was aware of the potential risk involved in the blurring line between co-teaching and researching and wanted to air these issues with my colleagues. A discussion was held with both teachers to explore the potential risks and ensure that any concerns were addressed, however none were voiced at this meeting. It was agreed that any concerns that may arise during the course of the research would be shared in an open and honest manner.

5.3. Data Gathering

As noted in the *data collection methods* section above, data for each case study was gathered through observations, artifacts, and interviews.

Observations occurred during April 2017. In case studies 2 & 3 involving students, these observations took place over three separate sessions, lasting 20 minutes each. In case study 1, involving teachers only, two 30-minute observation sessions were held. Notes were taken on the observation schedule (Appendix A), which was developed prior to the visits, and shared with the participants before observations took place. The observation schedule was based on collaborative skills identified by Sharratt and Planche (2016) and Murphy (2004), to which I added possible actions involving digital technology - based on my own teaching experiences. This was a means to focus my observations on the collaborative skills *as well as* the digital technology aspect of the research, with the listed actions acting only as a guide – not a checklist.

Artifacts were collected from participants during April 2017 via email and the sharing of links to digital documents such as Google Docs. Photographs were taken at each of the research locations. Artifacts and notes from observations were stored on my password protected computer.

Interviews took place in May 2017 and consisted of two types, semi-structured for teachers and focus group for students. Semi structured interviews were held at the participants' schools at a time and date of their choosing, and took no longer than one hour. Ten key questions (see Appendix F) were formed based around the research questions, as well as interpretations from artifacts and observations, and sent to interviewees prior to the interview taking place. Due to the semi-structured nature of the interview, other questions were asked in response to initial answers given. Transcripts of the interviews were sent to participants for member checking.

Focus group interviews involved six students in each of the two case studies involving student participants. Nine key questions (see Appendix G) based around the research questions, observations and artifacts were

formed. The purpose of the study and interview was revisited with students as over a month had passed since the initial classroom visit and I wanted to ensure they clearly understood the process.

Conventions of focus group interviews were discussed in age appropriate language and ground rules established. These became part of the ongoing assent process and were taken from work by Jennifer Gibson (Gibson, 2012, p. 149). These included:

- You can say “pass” if you don’t want to answer;
- Take time to think before you answer;
- Tell me if I don’t understand you, or if you don’t understand me;
- There are no right or wrong answers; say what you want;
- I won’t tell other people what you say;
- Take turns talking;
- No teasing or making fun.

All interviews were recorded using a digital voice recorder and the audio file downloaded onto my laptop. The interviews were then carefully transcribed and the transcripts of semi-structured interviews were sent to participants to be checked and amended, if needed. All audio and written forms of interviews were securely stored on my password protected computer.

5.4. Analysis of Data (coding):

Data analysis in qualitative research involves making sense of the raw data, in order to construct answers to research questions. The data is typically large in quantity, primarily in text form, and is not straight forward to analyse (Cohen et al., 2011). Bryman (2016) acknowledged that adding to this challenge is while there are general approaches to qualitative data analysis, there are no well-defined rules.

One approach to qualitative data analysis is known as *thematic analysis* and this is the approach chosen for this study. It involves "identifying themes and patterns of meaning across a dataset in relation to a research question" (Braun & Clarke, 2006, p. 175). There were several reasons for choosing this particular method. Firstly it offers flexibility in terms of fitting with a wide range of research types. Secondly it is viewed as being more easily accessible to beginner researchers, and lastly, the results can be understood by the wider education community (Braun & Clarke, 2006).

5.4.1. Thematic analysis – steps taken

The first part of thematic analysis in this study was to familiarise myself with the data. This involved immersing myself in the data (Braun & Clarke, 2006) which happened throughout data collection. During the early stages of data collection, observations were conducted and documents collected in order to develop meaningful interview questions. This involved close reading and viewing of data in order to select relevant areas to focus on for the interviews. Cohen et al. (2011) refer to this as a funnelling effect – "moving from the wide to the narrow"(p. 541). I also conducted all of the interviews myself and transcribed these in full. This made the data very familiar to me, as this process required repeated close listening. I then reviewed all of the data once again, re-reading transcripts and observation notes, and re-viewing photographs and documents.

The second part involved a close reading or viewing of the data. This was carried out on a printed version of the data (including documents and photographs) using a highlighter and pen. Any words, phrases, or images of interest in relation to the research questions were highlighted. I also recorded initial interpretive thoughts and questions for further exploration, in the margins. Examples of highlighted sections included: repeated concepts, keywords relating to the research questions, contradictory statements, and the use of personal or plural pronouns.

The third part was concerned with an initial coding of the data. Braun and Clarke (2006) define a code as “a word or brief phrase that captures the essence of why you think a particular bit of data may be useful” (p. 207). This was done using the paper data from the previous step. Words, phrases and images that had already been highlighted in the data, as well as my own initial thoughts and questions, were revisited and given codes. New sections were also highlighted and coded as subsequent readings developed further points of interest. Many sections of text were coded more than once as they captured several points of interest. Examples of these initial codes included: interpersonal skills, effective communication, and flexibility. I then reviewed the codes once again, combining some which were very similar in meaning, and refining others which were unclear e.g. *students learn from others* and *students as teachers* became *students as experts*.

The fourth part of the analysis process involved collating the coded data. I placed the data from each case study onto a spreadsheet (see Figure 1). The spreadsheet included the codes I had developed (along the top of the sheet), as well as which dataset the text came from (located down the side of the sheet). Coded text from each dataset was placed under the appropriate code headings.

A	B	C	D	E	F	G
	Shared digital items (gc	**Feedback**	**Students as experts**	**Anywhere anytime learning**	**Rewindable learning**	**Devices as Tools (balance)**
Student Focus group interview	As: last year we umm my cl Ph: oh yeah true P: and Miss H she could ad L: are there times when you H: well you might delete sor As: like one time we were d M: yeah we had these tasks	As: last year we umm Ph: oh yeah true P: and Miss H she cou H: so like if it's like I'm As: umm like earlier w P: umm I think it's a lot H: commenting L: ok, explain H: umm cause like we L: so you're giving mor P: I agree A: I agree as well As: me too H: I think it's helped in	P: umm then if you have any H: I agree with P and its it he H: so like if it's like I'm the tea H: commenting L: ok, explain H: umm cause like we were l L: so you're giving more mea P: I agree A: I agree as well As: me too	As: last year we umm my class we use to umm like umm talk Ph: oh yeah true P: and Miss H she could add a comment on our slides then a As: last year we umm my class we use to umm like umm talk Ph: oh yeah true P: and Miss H she could add a comment on our slides then a L: ok, another question then, do you think technology helps y As: umm like earlier we were talking about the comments tha P: umm I think it's a lot easier cause if you need help like stra		As: I honestly umm this is persor
Teacher Interview	Google suite (docs, forms,	CL: our DP came in th S: I've found that its I f S: different year level,	our DP came in the other da S: I went into another hub wit S: different year level, syndic CL: we found that we were gi	CL: it opens up so many more do	CL: That particular lesson	CL: that example I gave you is ch S: but they're a learning tool (.) w
Observations and Documentation	Google suite (docs, forms,	Instant, anywhere & ar	Writing programme, students (alongside teacher) teaching your		Flipping back on pages on	What tool is best for this job? Nee

Figure 1. Example of fourth stage of thematic analysis

Doing this allowed me to see which codes were well represented, consider the place of codes that seemed to be outliers, and identify codes that seemed to contradict others. It was important at this stage to avoid making decisions based on the frequency of data in a collated set, rather it was about the relevance of that data in terms of addressing the research aim (Bryman, 2016). For example, the code *re-windable learning* from case study 2 (student-to-student) contained little data, but was an important factor in how digital technology was being used in that setting. Some codes were eliminated at this stage as they contained very little data relevant to the study – an example here is the code of *faster learning progression* from case study 3 (teacher-to-student).

The fifth part required grouping the coded data in order to determine broader topics or issues running across all the case studies, and give these labels. This is known as *identifying themes* and involved reviewing the collated data, and looking for patterns and correlations between codes (Braun & Clarke, 2006). During this stage, several themes were developed, given tentative names, and then reviewed once more against the collated data - with some themes being discarded or merged together. It was also important to ensure that the themes represented the essence of the data relative to the research questions of this study. At this stage Braun and Clarke (2006) suggest creating a visual thematic map (see Figure 2) to “explore and refine the connections” (p. 232) between themes. This also allowed me to look at connections in relation to the research questions, and across the case studies.

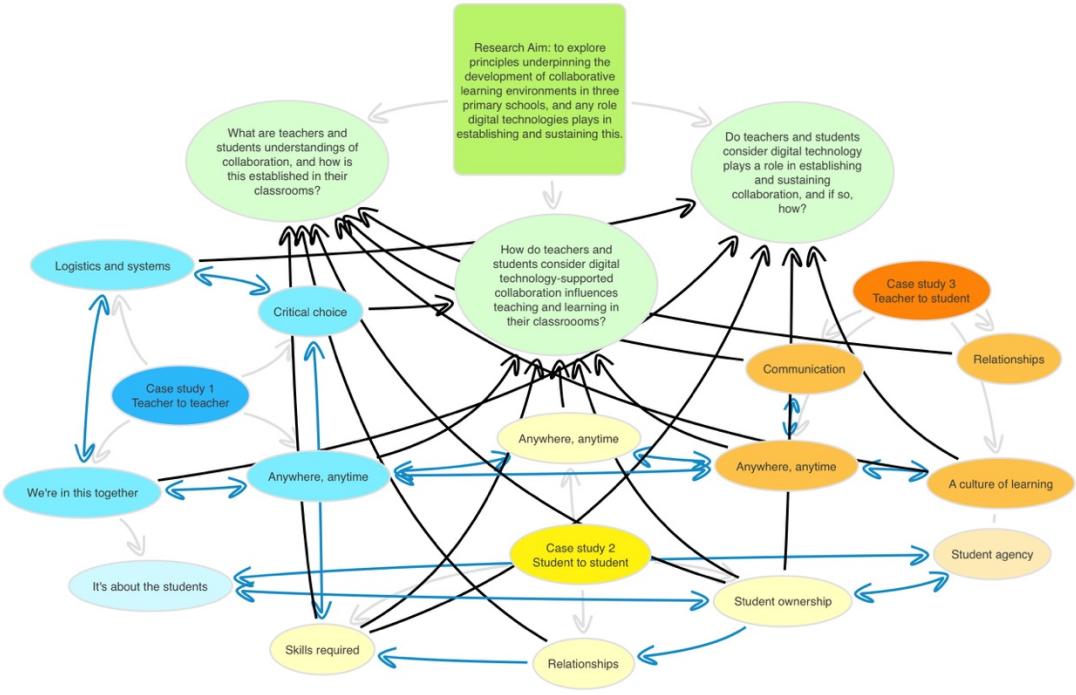


Figure 2. Visual thematic map

The grey lines on the visual thematic map indicate themes and subthemes of individual case studies; single black lines show links between a theme and a research question; blue bi-directional arrows show a close reciprocal relationship between themes; and blue one-directional arrows show one-way links between themes.

The sixth (and final) part of the thematic analysis process was to define and name the themes which had developed across all three case studies, and to select relevant examples from the dataset to illustrate these (Braun & Clarke, 2006; Mutch, 2013). It is important that theme names reflect the codes found within them, encapsulate large amounts of data, and give a clear understanding of that data (Bryman, 2016). Defining and naming the themes helped to give more focus to them, allowing me to be sure that I had created a rich overview of the data from all case studies and that my research questions had been addressed.

At this stage it became apparent that the themes were emerging under two areas. The first area contained themes directly connected to

collaboration, the second held themes relating to the collaborative use and the influence, of digital technology. Accordingly, the seven themes that emerged across the case studies were placed under two main theme sections:

A. Teachers' and students' views of collaboration.
B. How digital technology is used to support and enable collaboration.

Table 3 displays the themes and subthemes, a brief description of each, and sample data bytes.

Table 3. Collective case study theme descriptions and sample data

Section A: Teachers and students views of collaboration	**Subtheme 1: Building collaborative relationships**	**Subtheme 2: Skills for success**	**Subtheme 3: We're all in this together**	**Subtheme 4: Developing a culture of learning**
	Relates to the importance of building positive relationships and the need for honesty and trust. Working together in the best interest of the students in the class.	Encompasses the specific skills that are required for successful collaboration, including communication skills, compromise, and the ability to have challenging conversations.	Relates to having a shared understanding and joint sense of responsibility towards the teaching and learning taking place in the classroom.	Connected to all members of a classroom viewing themselves as both teachers and learners, and in the development of reciprocal working relationships.
Sample data bytes	"I'm going to touch base with those harder to reach children … it's not until you do that that you actually start building connections and gaining trust …" (Ana, CS3)	Planning session - constantly adding to each other's thinking, willingly dropping an idea in favour of the other persons. (Observation, CS1)	"you have to remember with your group, like, what were the clues that helped you through it?" (Anahera, FG/CS2)	"in this environment, it's being able to… yeah, kind of up skill me and my understanding around it as well." (Kate, CS1)

Section B: How digital technology supports and enables collaboration.	**Subtheme 5: Anywhere, anytime**	**Subtheme 6: Critical choice**	**Subtheme 7: It's my turn now**
	Flexibility that digital technology offers in regards to time and space. Includes the notion of being able to rewind learning.	Concerned with the critical and strategic use of technology by both teachers and students to enable and enhance collaboration. Taking risks in using digital technology, learning from these experiences.	How students view collaboration using technology, the impact of technology access on collaboration, and how they perceive their individual contributions to collaborative tasks.
Sample data bytes	"we could add on to it and we don't just have to be at school, we can be at home" (Riley,FG/CS2)	multiple users view and edit the same piece of work. (Artifacts, CS3)	"you can't say it's my turn now and then type something, only they are allowed to do anything on it!" (David,FG/CS2)

The next section discusses how trustworthiness and authenticity were maintained throughout the research process.

6. Trustworthiness and authenticity

While quantitative research highlights reliability, validity and generalisability as key to the quality of a study, these can be difficult criteria for qualitative research to meet (Bryman, 2016). A different position is proposed for qualitative research by Guba and Lincoln (1994) who suggest the terms trustworthiness and authenticity.

According to Bryman (2016), trustworthiness entails four criteria; credibility, transferability, dependability, and confirmability. It requires the researcher to have clearly documented all aspects of the research, produced detailed and credible accounts of findings, and taken an ethical approach throughout (Bryman, 2016; Mutch, 2013). Authenticity calls for ensuring a fair and balanced representation of the studied participants is reported, and that there will be a benefit to all those connected to the research (Cohen et al., 2011).

Trustworthiness and authenticity were maintained in this study primarily through triangulation, as well as selecting appropriate participants, keeping detailed records of each part of the research process, and taking a reflexive approach to all stages of the research process. Semi-structured interview transcripts were sent to participants to read, review and make any changes to before analysis was started. This was done to ensure the transcript was an accurate reflection of their feedback. The research will also be shared with the schools involved (as well as the wider education community) so they can benefit from this, using the results as desired.

7. Summary

The theoretical framework of this study has been discussed. It is underpinned by an interpretivist paradigm, aiming to understand an individual's interpretations from within their own setting. This focus on understanding the individual and how they construct their own understandings has also been shown to fit within my own constructionist ontology and social constructivist epistemology. These beliefs also had an impact on the methodology and data collection methods chosen for this study. These methods have been discussed, their inclusion justified, with any major concerns acknowledged and addressed.

This chapter also outlined the research process undertaken. Participant selection has been discussed, as well as ethical issues such as: access and acceptance, informed consent, and insider research. The data gathering process has been explained, as well as the steps taken to analyse the data and how themes were reached. Finally, issues of trustworthiness and authenticity were raised and addressed.

The following chapter presents the findings of this research.

Chapter Four: Findings

1. Introduction

This research aims to explore understandings of collaboration, and the role digital technology might play in collaborative practice within innovative learning environments. It involves three case studies and focuses on the understandings and experiences of different groups of participants. The findings of this research will be discussed in two main theme sections comprising seven subthemes – as established in the previous chapter. As also discussed in Chapter Three, these themes were developed from data collected across the three case studies: teacher-to-teacher, student-to-student, and teacher-to-student.

The first section begins by investigating the teachers' and students' understandings of collaboration. This has been done to provide a clear sense of the underlying beliefs about collaboration which drive the actions of the participants and in turn, influenced the data collected. This section then explores themes arising from the teachers' and students' views of collaboration in practice. The first subtheme in this section is *Building Collaborative Relationships*. This relates to the importance of building positive relationships and the need for honesty and trust. *Skills for Success* contains data relating to the specific skills that are required for successful collaboration, including communication skills, compromise, and the ability to have challenging conversations. The subtheme *We're All in This Together* comprises data relating to having a shared understanding and joint sense of responsibility towards the teaching and learning taking place in the classroom. Finally, *Developing A Culture of Learning* contains data related to all members of a classroom viewing themselves as both teachers and learners, and in the development of reciprocal working relationships between all members of the classroom.

The second section explores themes based on how digital technology is used by teachers and students to support and enable collaboration. The first subtheme is *Anywhere, Anytime,* which describes the flexibility that digital technology offers its users with regards to time and space. This subtheme also includes the notion of being able to rewind learning - whether at home or at school. *Critical Choice* comprises data concerned with the critical and strategic use of digital technology. This subtheme also presents data relating to the need to take risks with using digital technology, and to learn from these experiences. The final subtheme in this section, *It's My Turn Now*, explores the notion of how students view collaboration using digital technology, the impact of access, and how students perceive their individual contributions. This subtheme only contains data from the case studies directly involving students (cases 2 & 3) but has been included as the findings were unanticipated, and proved informative in how students view collaboration using digital technology.

Verbatim quotations relating to the themes have been used to promote the voice of the participants, aiming to provide a richness and authenticity to the findings. Italics have been used within quotes to indicate when participants quoted their own, or others, thoughts or comments.

2. Teachers' and students' views of collaboration

2.1. Understandings of collaboration

Case Study 1 – Teacher-to-teacher

Collaboration was seen by both Kate and Tama as an integral part of the successful running of their classroom. Kate defined it as "working with more than one person to do a better outcome than you can do without them". Tama agreed with the sense that both parties are needed, observing that when "it's true collaboration with a teaching buddy like Kate and I, the system doesn't function as well or it's not, it just can't work without that person the next day". Kate added; "with collaboration you

don't like outsource, *you do this and you do that,* you're kind of adding onto everything together".

Case Study 2 – student-to-student

When asked what they thought it meant to collaborate with others the students agreed that it was about teamwork and the sharing of ideas. Georgia felt that it was about "working well with others". Molly explained that it involved "using other peoples' ideas", and Riley added to this by saying that it was "not like copying though … you're supporting them". Anahera also felt that collaborating enabled her to "get more ideas, you get different opinions and can challenge each other's thinking".

The teacher in this classroom, Amber, defined collaboration as "two or more people working together … using all their knowledge to create a new idea". She likened it to baking a cake in that all parts are needed and can't be pulled apart once complete.

Case Study 3 – teacher-to-student

Collaboration was viewed by the students in this case study as people working together and using their skills to help each other. This comment from Lucy illustrates this; "it helps move your skills together so if someone's good at this but they're not good at something else and someone else is good at that then they can do it together". Siena felt that it also allowed problems to be solved faster because "you can figure it out together … with two you'd be able to like do it fast and as a group it'd get done in a second".

The teachers in this classroom viewed collaboration as a group of people having a shared vision and using each other's strengths to achieve a better result than what could be achieved alone. Emma expressed that this required "lots of open discussions", and Ana added that "you sort of, you kind of need to become one". Emma saw this as different from

cooperation, where “you’re just kind of getting through the task rather than dealing with frustrations and working through it together, having deep discussions about things”.

2.2. Subtheme 1: Building Collaborative Relationships

This subtheme presents data relating to the importance of taking the time to build positive relationships and the need for honesty and trust within these.

Case Study 1 – teacher-to-teacher

Tama and Kate viewed collaboration as essential, and developing a positive working relationship was viewed as a key element in achieving this. The concept of trust was brought up by both teachers as an integral part of their working relationship:

> I’m away all weekend and Kate may know that and she’ll say *look, I’ll get that done* but um she knows at the other end that if she’s busy …like, I will pull through and that is really powerful in our working relationship, that um nobody’s tracking the hours, you’re both just working, you’re giving what you can to get the job done
>
> (Tama).

> I see that as a perspective that you can take on things, about knowing that somebody’s doing their best … if you go actually *yip we’re here, we’re doing our best* you know and when you think of the other person *yep they’re doing their best* then you don’t track hours or how many you marked or all those things.
>
> (Kate)

There was a focus here on having faith that the other person is doing the best they can, both acknowledging that there has to be some give and take.

Kate and Tama both agreed that collaboration is challenging and requires time and trust to function well, however they were also quick to stress that the conflict which can arise in collaboration is an important element in its success. I saw an example of this conflict when observing a planning session where Tama was explaining an idea for a new topic which Kate was challenging him on, in order to gain a clearer understanding herself. This moment of conflict was discussed during the interview:

> **Tama:** I think to ensure we can collaborate we have to be able to trust each other that it's a working relationship and that we know conflict is best for our classroom.
>
> **Kate:** Yeah, we don't just want to say *oh yeah, good idea* we want to jump into it and nut it out so we both really understand it or you grow it better because we understand it from different perspectives.
>
> **Tama:** Yeah, that planning day was actually a really clear example 'cause I remember feeling at the start of that, I was at the *god this is conflict*, like I felt that conflict, and we got through it and I actually told Kate at the end that I felt that way, that it felt really good at the end because we'd worked through that.
>
> **Kate:** Yeah, 'cause we know we can't be on different pages for those big ideas.

Both stressed that collaboration needs time to succeed, and can easily default into cooperation when time is compromised. Tama explained, "you can tell when we haven't had enough time together because it's not a seamless programme, that we are disconnected and probably we go back to a cooperative state to get through the day". Kate also noted that "things just aren't as smooth when we haven't had time … we don't make big changes if we're both really busy". Working as a team was seen as important, and if they didn't have the time they needed together, then big decisions are not made until they *did* have the time.

Case study 2 – student-to-student

The ability to work well with others, to willingly share ideas and build trusting relationships which allow collaboration to occur was viewed as important by the teacher in this case study. Amber was strategic in her groupings of students in order to develop these relationships, ensuring that students got to work with a wide range of people. She explained that she wanted the students to understand that "when you're in a group you're only as good as the person next to you … so if you don't work together you know you're probably not going to succeed".

The students recognised the need to relate to a range of people. This comment from Molly reflected this understanding; "if we just kept working with our same buddy we would just be working with the same people not different people and wouldn't learn from them". Riley talked about the need for students to learn to work with a wide range of people as, when "you go to middle school and stuff you'll be used to working with one person and then … with someone else you might go *this is a bit weird*" (Riley). However, a possible inconsistency to this thinking was evident when Riley talked about using digital technology with someone new, and who you may find challenging, where she commented, "if they are a bit annoying you don't have to work right beside them 'cause you can just share to them".

Case Study 3 – teacher-to-student

Building positive relationships was seen as an essential part of developing a culture of learning. There was a conscious effort made by the teachers to connect with all students; "I'm going to touch base with those harder to reach children … it's not until you do that that you actually start building connections and gaining trust … that's been really valuable to learning" (Ana). Relationship building was done in person but also in a range of ways through digital technology, such as leaving comments on a student's piece of digital work. Jack enjoyed receiving feedback from his teachers,

explaining how “Miss E gave me some advice on my Google Slide and it made me feel good about my work”. During my observations, I noticed that the students would approach either teacher for support and also freely moved around the classroom as needed in order to work with, or ask for advice from other students.

2.3. Subtheme 2: Skills for Success

This subtheme contains data relating to the specific skills that are required for successful collaboration, including compromise, communication skills, and the ability to have challenging conversations.

Case study 1 – teacher-to-teacher

The skill of compromise was seen by Kate and Tama as an essential part of working together. Kate noted that there are times when the other person has an idea which may be a *better fit* than your own, expressing that “it’s like, *well that’s different, sweet we’ll do it that way*”. Tama felt that compromising did not always mean letting things go, rather “it’s ensuring that both ideas are just getting better, it’s like don’t just throw it out, how does it actually fit in?”. An example of this ability to compromise was particularly evident in a discussion around changing their literacy programme to be more integrated with the new topic. Both Tama and Kate had clear ideas on how they wanted the literacy programme to look but willingly listened to each other’s ideas and raised and discussed any concerns, with the end result reflecting a combination of their thinking.

Case study 2 – student-to-student

Several skills were identified by both the teacher (Amber) and the students as being important to successful collaboration. The first skill was being able to communicate with others, to both speak *and* listen. Amber discussed the need for students to learn the skill of how to have a conversation, “how to listen to someone, how to take someone’s idea on board”. She felt that students needed to be willing to participate and

interact with others, explaining that "you can't be a passive learner and if you don't contribute your ideas … are you actually collaborating?" (Amber). Some students saw the skill of communication also being used to "justify their ideas, they can't just say it without knowing what's behind what they're saying" (Anahera). David added to this perspective, noting that "when they say something to you, you say *tell me more about what you think*, that's like challenging why they think that".

Another skill highlighted by the teacher was that of negotiation, realising that "sometimes it's not going to work, it's not going to go your way and what are you going to do?" (Amber). This awareness of needing to negotiate with others was evident in my observations, with students making statements or asking questions of each other in order to come to an agreement. David shared his understanding of this, explaining that "you need to be friendly and not think of like, not too much self-smarts … thinking your ideas are the best and saying that you don't want their ideas". Negotiation was observed during a maths problem solving session when I heard students asking each other questions such as, "ok, so what do *you* think we should do?".

Case Study 3 – teacher-to-student

Having *challenging* conversations was seen by the teachers as an important skill to support successful collaboration, "if it's a challenging idea … it's about getting the best growth or the best thinking or the deeper thinking from the other people" (Ana) but this did require "not letting your insecurities or weaknesses … hold you back" (Emma). They viewed these conversations as a part of reflective practice, of "reviewing things and going backwards and forwards" (Emma), and that "until you get questioned by someone" (Ana), personal growth can be difficult.

The need to be challenged and to learn from mistakes was also echoed by the students. They discussed how they went about learning new

concepts, with Siena noting that when she is working with a buddy on a new computer program or application, they have to take some risks in their learning. Siena explained, "we tried something new that we'd never done … I pressed it and then… *oh that was close* and I pressed the wrong thing, but that's ok, 'cause we learnt not to do that next time". Lucy expressed that learning new things can be challenging and involved moments of frustration and celebration:

> You don't know how and you're finding out how to do it, like working it out and having frustrations and then finding out how to do it and like *weeeee* and then finding another frustration and going *ahhhh* and then going *weeee* again".
>
> (Lucy)

2.4. Subtheme 3: We're All in This Together

We're All in This Together captures the notion that teachers and students working in a collaborative setting need to have a shared understanding with regard to the learning they take part in, and how *they* function together as a team.

Case study 1 – teacher-to-teacher

A shared mind-set was reflected in the emphasis both Kate and Tama had on their students, who are the focus of all decisions made – regardless of the challenges involved. For example, Tama commented that "everything we talk about is to make sure that it is student-centred". Kate added to this, noting that "we've never had a conversation of how can we do this the easiest way, like that doesn't exist because I guess you'd call each other out". This focus on the students was clearly illustrated in my observation of their planning session where there was constant reference to individuals, small groups, and the class as a whole. Ideas put forth regarding new topics, changing of programmes, tracking systems and so on, were assessed against the needs of the students and the potential benefits they could gain from these new ideas.

Kate reflected that:

> There were times when we would have written something on our weekly plan and then started to do it and we're like… *oh I thought it was going to be this way or I thought it was going to be that way* … we were like, we've actually got to talk about things.
>
> (Kate)

Through personal experience, they had realised that they needed clarity in everything that was happening in the room, and that they couldn't just assume that a shared understanding existed. Any changes that were made, were made with the other person in mind, and systems had been put in place to ensure a shared understanding could be reached. This included using digital highlighters on documents for items which needed clarification.

Case study 2 – student-to-student

Having a mutual understanding of the process and outcome of collaboration was seen as important. When discussing a robotics task, Anahera explained how, "you had to make sure your whole group got a turn …and like … understood how to do it and all the degrees and what buttons are which". A shared understanding was viewed as important because they could be asked to lead the learning in another group, and "you need to know how to do it to tell them and to help them" (Chelsea).

In relation to developing shared ownership, instructions given to the students during observations stressed the need for all members of the group to be able to understand the task and be able to share the groups findings with others. Anahera gave an example of this when she talked about the maths problem-solving element of their class programme; "when we do problem-solving it makes you think a lot more because you have to remember with your group, like, what were the clues that helped you

through it?". During an observation session I noted members of several groups stressing the need for them to all be involved, with one student stating "let's just crack on with this, we should put this (iPad) on the ground so we can all see what we have to do". Students knew the expectations and would readily remind other students of these, if they needed to.

This ability to share with others also extended outside of their classroom, which seemed to amplify the need for each student to fully understand the task. Molly explained that "if we were teaching juniors, we would have to know how to do it and put it into a more understanding (*sic*) and easier way". There was a sense of responsibility when sharing with junior students, and also a recognition of the risk involved in passing on incorrect information, as noted in this interview extract below when I asked them why they thought everyone in the group had to understand the task:

> **David:** yeah because if the teacher asked you to go help the juniors then you'd be stuck because you don't know.
>
> **Anahera:** you didn't work with your group.
>
> **Georgia:** and then you could be telling them wrong stuff which gets them into trouble.
>
> **Chelsea:** and then that would make *them* tell everyone else the wrong stuff.
>
> **Georgia:** and then no one would find out the proper way 'cause everyone would just be telling the wrong way.

The students saw the bigger picture in terms of the impact they could have on the learning of their peers, and how this extended further than just the individuals they worked directly with.

Case Study 3 – teacher-to-student

The students noted the benefits of working as a team, and the importance of recognising that they all needed to contribute to the task. Lucy noted the support that working with others brought, explaining how "sometimes you get it wrong, and then you go through it again with your buddies and … they can make it easier for you to understand". James discussed the need to *play your part* in the team and ensure the task is completed, expressing that everyone has "to help each other get the work done and we have to all try our best".

When observing a coding lesson I noticed students referring to the set task and talking about how they were progressing as a group. They were reflecting on the steps they had completed and those they still needed to work on; "well we've done the first bit of the instruction and I think it looks cool but we haven't worked out our next step yet – who's got a good idea?". Another group was observed discussing whether everyone understood what they needed to do next, with one student asking, "are we sure about that? Who actually knows what we need to do now … should we check?".

2.5. Subtheme 4: Developing A Culture of Learning

Developing A Culture of Learning comprises data related to all teachers and students viewing themselves as both teachers and learners, acknowledging strengths and weaknesses, and in the development of reciprocal working relationships between all members of the classroom.

Case study 1 – teacher-to-teacher

Tama and Kate both recognised the individual strengths each brought to their working relationship. This was seen as a real bonus of working with another person - being able to learn from each other, and in turn, have a greater impact on the students in their room. Kate noted that in terms of iPad app use:

> Tama's done a lot more of that than I have, but I constantly learn new bits from that, so in this environment it's being able to… yeah, kind of up skill me and my understanding around it as well.
>
> (Kate)

When talking about how he had developed professionally since working with Kate, Tama explained that not only had he learned from her but he had also had the opportunity to develop his own skills through supporting her learning.

> Like honestly in every curriculum area I've learnt so much and probably been given the opportunity or the support to develop the things that I wanted to, as well like the te reo in the classroom and the use of technology. I've grown with that as well because I've had the opportunity through collaboration.
>
> (Tama)

Case study 2 – student-to-student

Students in this classroom had an awareness that they were surrounded by teachers - that each student could be viewed as a teacher as well as a student. The classroom teacher, Amber, recalled a conversation with one of her new students where Amber asked her how many teachers the student saw in the room. The student responded by saying that there were a lot of teachers, there were what she called the *physical teachers* who were the adults in the room, and then there were all of the students too. She also noted that, "she didn't realise that she had weaknesses in some areas and she's learning from other students now" (Amber).

Collaborative tasks were seen by the students as a way for them to learn new skills from others; "if you don't know all the skills, they can help you … they can explain and show you and like… get you to also do it yourself" (Anahera). This was clearly on display during classroom observations

where I noticed many instances of students upskilling each other as needed, while they worked through a task. An example of this occurred during a robotics session where one student had a strong skill set in this area and was supporting the other members of his group. There was confusion over where to connect a device and this student responded with "let's have a look, what port are you plugged into? Ok, let me show you how, we need to make a few adjustments".

Case study 3 – teacher-to-student

Recognising students as teachers was one way Ana and Emma developed a *culture of learning* in their classroom. Emma spoke to me of a moment when she and a group of students went into another room to share their knowledge of the online writing forum, Night Zookeeper. One of the questions the teacher had was specific to the student part of the program, so Emma asked one of the students if he would mind showing them how it worked. She shared that he was able to "explain eloquently in very plain English for these children who were younger", and did so much more successfully than she thought she could have done.

I personally observed students being used as *teachers* during a coding lesson. The students used a shared spreadsheet based around set coding tasks to identify a peer who could help them. Ana discussed this during our interview, noting that "they then become the teachers … they go, *right that person there … I can pick whoever I feel most comfortable with and go and have a conversation with them*".

Students spoke of the benefits of utilising people who may offer skills different to theirs:

> If you have any problems and someone else is on the same problem as you, you guys can just figure it out together cause if you're by yourself you'd be like … just sitting there and trying to think.
>
> (James)

> It helps move your skills together so if someone's good at this but they're not good at something else and someone else is good at that then if they need to do it together … but they don't know how to do each other's thing, they can do it together.
>
> (Hera)

The students also gave examples of times when *they* helped the teachers, this is illustrated here by James who was discussing adding an image to a Google Form, explaining that, "Miss A didn't know how to do that and when I showed her, she was amazed".

The classroom has developed a *kaizen wall* (see Figure 3) which includes a section where students are able to share their "areas of expertise or strengths" (Ana). This wall is a place the students and teachers can go to if they need support in a certain area of their learning - they are able to see who could offer them guidance and approach that person for help. Ana recalled a time when the deputy principal came into the class looking for support with a computer program and they pointed her in the direction of the wall. As Ana explained, "she just went *oh good, I'm going to pick that person, you've got an expertise in that area*". The wall had given students opportunities to lead in their own areas of strength - which the teachers felt was particularly important for those students who struggle in the core learning areas.

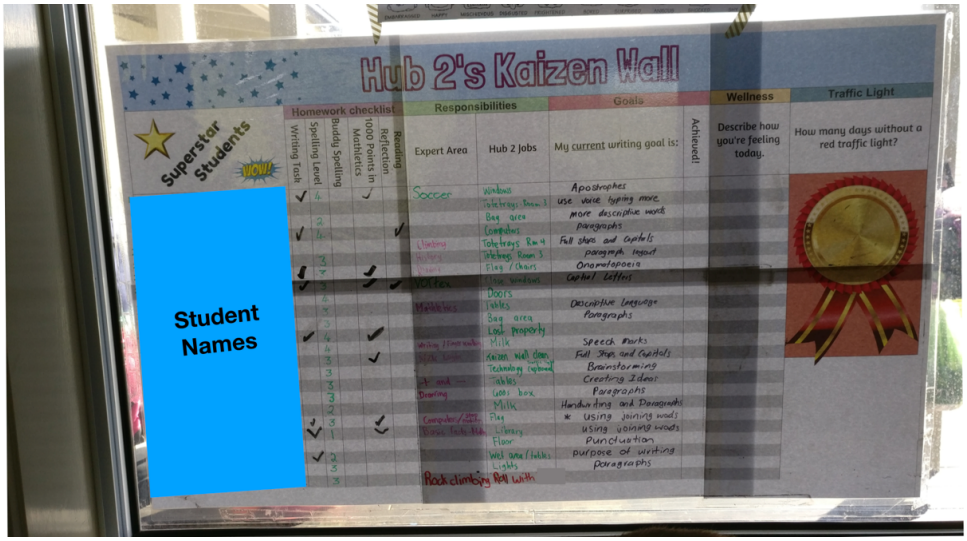


Figure 3. Kaizen Wall - including area for identifying student expertise.

3. Part B: How digital technology is used to support and enable collaboration.

3.1. Subtheme 5: Anywhere, Anytime

The subtheme *Anywhere, Anytime* encompasses the flexibility that digital technology offers its users in regards to time and space. This subtheme also includes the notion of being able to rewind learning - whether at home or at school.

Case study 1 – teacher-to-teacher

A key benefit of digital technology identified by Tama and Kate is that it allows for collaboration to happen wherever and whenever required. Tama noted that "our planning system allows us to bounce ideas between each other without being in the same space". This is illustrated in his following comment:

> So if there's nothing on the plan tomorrow for the afternoon, I'll put something on … I'll highlight it yellow or whatever. Kate will come in and she may alter it, do it again and put a new colour and when that colour's gone, both parties are happy.
>
> (Tama)

There was an understanding by both teachers that they each have a life outside of school or simply might need a break sometimes and they felt that part of the success of their working relationship was dependent on respecting this. Kate explained how this ability to work anywhere and at any time was important here, "cause you know for us we have our lives outside that we both value as well". Tama felt that there could be times when a break from the school environment was needed and digital technology could assist with this:

> If working closely with someone and having that intense communication on a day to day basis is a problem some days then the technology assists that, because it's like *I've gotta (sic) go home now and get out of school* but you'll say *look I'm on my computer though*.
>
> (Tama)

While this ability to be flexible in where and when they work is seen as a benefit, it was also noted by both Tama and Kate that their most powerful collaboration happened in person and that digital technology became almost an invisible part of this process. Tama shared that their "most powerful moments of collaboration are when we nut something out in person together". Regarding digital technology use, "most of it would be at the planning stage of like when we're researching … you know *I've got this idea*, you kind of look for it online" (Kate).

Case study 2 – student-to-student

The ability to use digital technology within a range of spaces and times was viewed as a key benefit to collaboration by the students and their teacher. During my observation sessions students were seen working collaboratively in a range of spaces in and around the classroom. Groups were working in various places inside the classroom where the physical environment allowed them to shut off certain sections of the room to give them a private place to work. Portable devices and wireless internet

capabilities also allowed groups to work outside on the deck areas or other spaces around the school.

When asked why they had chosen to work out on the deck, a group member responded with; “we can think better out here away from everyone else”, another member added to this comment, explaining that “sometimes you just need a different space so you can focus a bit better”. I asked the students in the focus group interview whether they thought being able to use digital technology to work in a range of spaces was important in terms of collaboration, and they agreed that it was. Riley felt that digital technology offered her flexibility in where she was able to work, sharing an example of a time she and a friend “made a Google Slides doc at school so we could add on to it and we don’t just have to be at school, we can be at home”.

The teacher, Amber, also viewed the flexibility of space and time as an important aspect digital technology could bring to collaboration. During observations, students were encouraged to work in spaces which fitted the purpose of their learning task, and enabled best use of the digital technology. This flexibility is illustrated by a student who reflected on a time she needed to work in a different physical space than her partner. She explained how she “shared it with my buddy and then we typed it, like I was sitting here but my buddy was in a different room and we didn’t have to sit right beside each other” (Georgia). Amber also explained that the technology, “enables students … to collaborate outside of the traditional learning space … you can see at night that they’re working away at things and getting feedback from each other”.

The use of digital technology also allowed students to *rewind* their learning, if required. Weekly timetables were shared with students alongside group tasks and learning resources, all of which could be accessed at any time. Amber felt that this gave students more agency

over their learning, explaining that, “they can replay learning now whereas before they couldn’t. If they didn’t get it they’d have to catch you next time round … now they can take ownership of it as well”. This was observed during a maths problem-solving session where students were finding the work challenging, with one stating, “how do we do that again?”. They then re-watched the lesson videoed from the previous day, stopping and starting this several times before continuing on with the set task.

Devices also allowed students to rewind their own digital creations in order to recraft or consolidate thinking. My observation data showed that students regularly re-viewed their work, solving problems in small chunks as they worked their way through a task. An example of this was during a dance session where students had to create their own dance item to tell the story *The Battle of the Mountains.* They made comments such as; “let’s try that again” - before restarting music, and, “we have to wait for each other to start – let’s start the music again”. Students constantly stopped and started the music and their dancing, and often referred back to information on the digital slideshow shared by the teacher.

Case study 3 – teacher-to-student

Digital technology was viewed by both the teachers and the students as an important way for them to work collaboratively across different times and spaces. As Ana explained, using digital technology “opens up so many more doors to be able to collaborate, you’re extending the opportunities outside of the four walls of the classroom”. One of the students, James, gave an example of how he felt the technology allowed for collaboration across different spaces, remarking that, “you can like Facetime someone and talk to them like they’re just next to you”. His comment echoes those of the other students who discussed being able to email, access shared documents, and message each other and their teachers from home, if required.

The students also discussed how digital technology lessened the wait-time involved in working on a task. Lucy shared how she liked being able to contact her teachers at any time about her work; “if you need help like straight away then it’s there and the teachers are usually on their device”. Jack added to this thinking, observing that “it’s definitely helping ‘cause you don’t have to wait like 12 hours til (*sic*) you see the teacher again”.

The teachers and students also expressed that being able to *re-wind* with digital technology to view, review, and edit work, supported collaborative practice. Ana explained that digitally recording or saving work was very helpful and they did this across a range of subjects, “so the next day at say Maths, you can say *oh remember when we did that* and bang, it’s up there on the screen”. She felt that the students responded well to this and it especially helped those who were finding a new concept challenging as they could access digital resources at home and school, as often as required. This ability to *rewind* learning was noted during my writing lesson observation when Ana flipped back and forth between slides on the interactive whiteboard, collaboratively adding to and editing sections of the report planner. Additionally, it was visible in the way the students kept referring back to the saved plan the class had created together while starting to formulate their own work.

3.2. Subtheme 6: Critical Choice

The subtheme *Critical Choice* relates to data concerned with the critical and strategic use of digital technology by both teachers and students to enable and enhance collaboration. It also contains data about the need for teachers and students to take risks with the digital technology choices being made – and learn from these.

Case study 1 – teacher-to-teacher

The use of digital technology is driven by the needs of the teachers and the students. Tama stressed their need to focus on the students through his comment that, "all the systems we've got set up have them right at the middle". Kate agreed, also pointing out that she believed that as their and their students' needs *do* change over time, the digital technology itself also needed to be flexible. She explained that "it does need to alter and change as we discuss and need different things at different times of the year" (Kate).

Tama and Kate felt that working closely with another teacher was enhanced by the creation of digitally-based systems which can be used to: plan, track learning, communicate with parents, and enable collaboration. The digital technology-based systems put in place were constructed to best support these needs and "make what we want to do possible" (Kate). Their "use of technology is a result of our collaboration" (Tama), indicated a strong belief that digital technology comes second to the collaboration and learning taking place. The outcome of this belief is a set of digital systems which put the people involved at the centre, and are constantly evolving according to need.

Cloud-based systems such as Google Docs and Google Sheets were used for planning and for tracking student progress. These systems allowed both teachers to communicate where certain students are at, so "we can both see who's conferenced and everything about that child" (Kate). Documents ranged from simple tracking keys in core subjects, through to more in-depth notes about students - both academically and pastorally. Tracking documents had also been created between the teachers and learning assistants to monitor students, and ensure a shared understanding of their needs. These tracking systems were also used for communicating with parents. Figures 4 & 5 show some examples of these tracking sheets.

Figure 4 shows the tracking of students against the school's numeracy learning progressions. A simple key was used to indicate where a student sits against the progression. Figure 5 displays tracked achievement in literacy, and includes a range of information such as initial reading levels, notes from recent running records, and achieved goals.

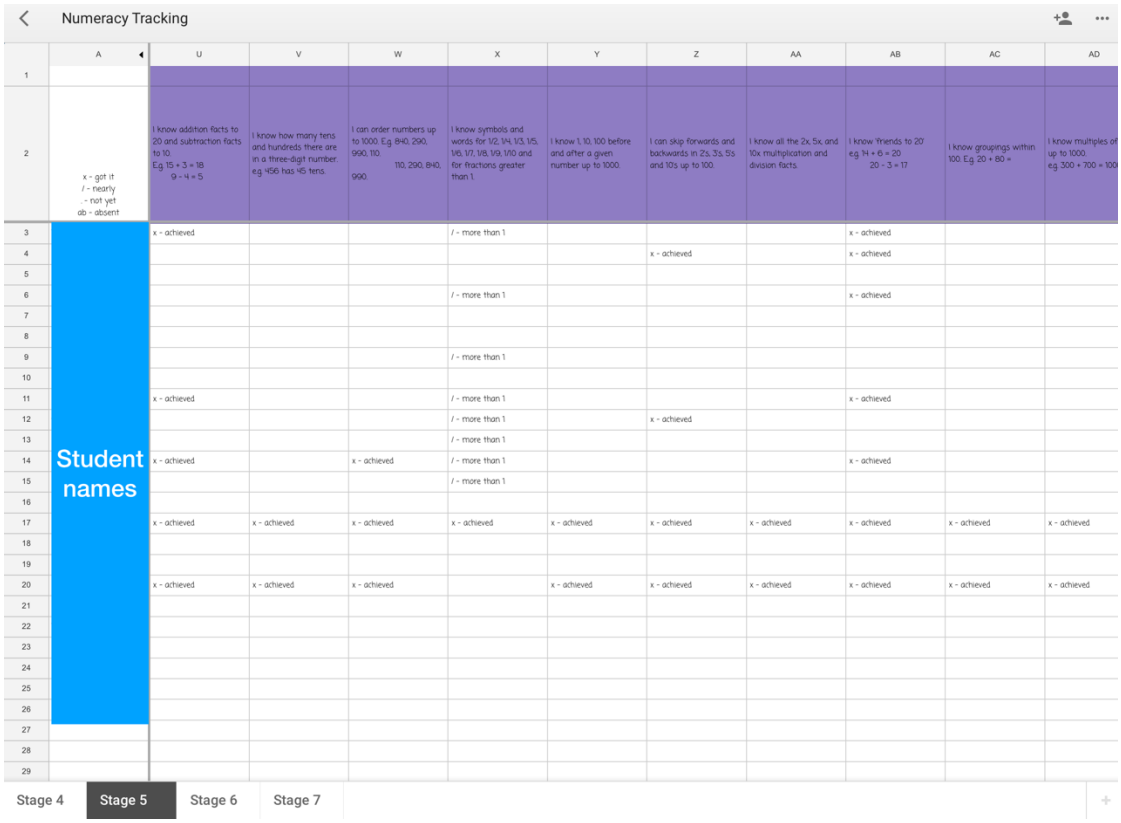
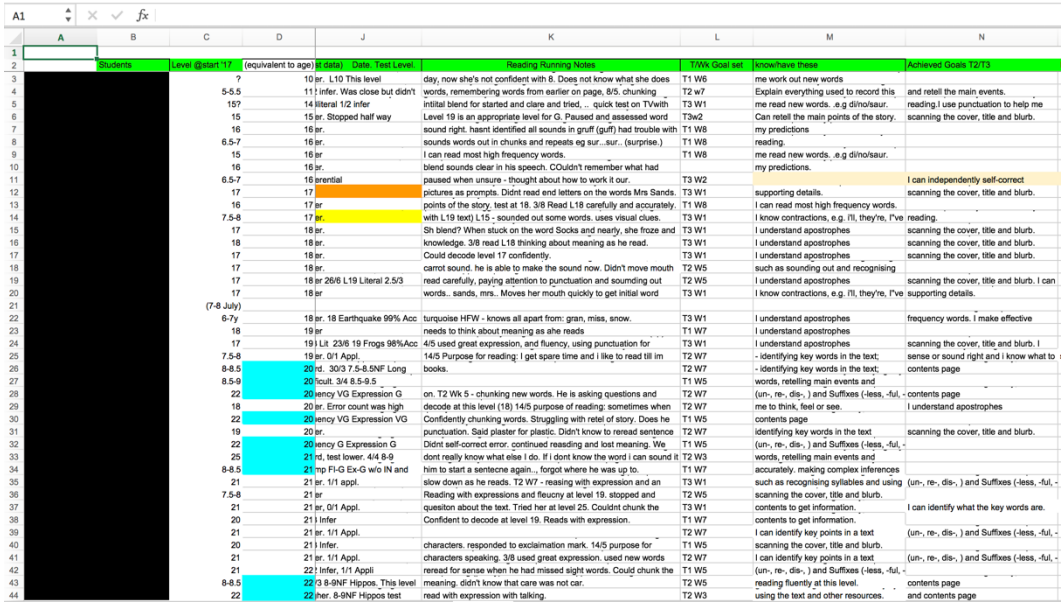


Figure 4. Numeracy tracking sheet showing use of a key system against learning progressions.



Students	Level @start '17	(equivalent to age)	lt data)	Date. Test Level.	Reading Running Notes	T/Wk Goal set	know/have these	Achieved Goals T2/T3
	?		10	er. L10 This level	day, now she's not confident with it. Does not know what she does	T1 W6	me work out new words	
	5-5.5		11	Infer. Was close but didn't	words, remembering words from earlier on page, 8/5. chunking	T2 w7	Explain everything used to record this	and retell the main events.
	15?		14	literal 1/2 infer	intital blend for started and clare and tried, .. quick test on TVwith	T3 W1	me read new words. .e.g di/no/saur.	reading.I use punctuation to help me
	15		15	er. Stopped half way	Level 19 is an appropriate level for G. Paused and assessed word	T3w2	Can retell the main points of the story.	scanning the cover, title and blurb.
	16		16	er.	sound right. hasnt identified all sounds in gruff (guff) had trouble with	T1 W8	my predictions	
	6.5-7		16	er.	sounds words out in chunks and repeats eg sur...sur.. (surprise.)	T1 W8	reading.	
	15		16	er	I can read most high frequency words.	T1 W8	me read new words. .e.g di/no/saur.	
	16		16	er.	blend sounds clear in his speech. COuldn't remember what had		my predictions.	
	6.5-7		16	erential	paused when unsure - thought about how to work it our.	T3 W2		I can independently self-correct
	17		17		pictures as prompts. Didnt read end letters on the words Mrs Sands.	T3 W1	supporting details.	scanning the cover, title and blurb.
	16		17	er	points of the story. test at 18. 3/8 Read L18 carefully and accurately.	T1 W8	I can read most high frequency words.	
	7.5-8		17	er.	with L19 text) L15 - sounded out some words. uses visual clues.	T3 W1	I know contractions, e.g. i'll, they're, I've	reading.
	17		18	er.	Sh blend? When stuck on the word Socks and nearly, she froze and	T3 W1	I understand apostrophes	scanning the cover, title and blurb.
	18		18	er.	knowledge. 3/8 read L18 thinking about meaning as he read.	T3 W1	I understand apostrophes	scanning the cover, title and blurb.
	17		18	er.	Could decode level 17 confidently.	T3 W1	I understand apostrophes	scanning the cover, title and blurb.
	17		18	er.	carrot sound. he is able to make the sound now. Didn't move mouth	T2 W5	such as sounding out and recognising	
	17		18	er 26/6 L19 Literal 2.5/3	read carefully, paying attention to punctuation and soumding out	T2 W5	I understand apostrophes	scanning the cover, title and blurb. I can
	17		18	er	words.. sands, mrs.. Moves her mouth quickly to get initial word	T3 W1	I know contractions, e.g. i'll, they're, I've	supporting details.
	(7-8 July)							
	6-7y		18	er. 18 Earthquake 99% Acc	turquoise HFW - knows all apart from: gran, miss, snow.	T3 W1	I understand apostrophes	frequency words. I make effective
	18		19	er	needs to think about meaning as she reads	T1 W7	I understand apostrophes	
	17		19	Lit 23/6 19 Frogs 98%Acc	4/5 used great expression, and fluency, using punctuation for	T3 W1	I understand apostrophes	scanning the cover, title and blurb. I
	7.5-8		19	er. 0/1 Appl.	14/5 Purpose for reading: I get spare time and i like to read till im	T2 W7	- identifying key words in the text;	sense or sound right and i know what to
	8-8.5		20	rd. 30/3 7.5-8.5NF Long	books.	T2 W7	- identifying key words in the text;	contents page
	8.5-9		20	fcult. 3/4 8.5-9.5		T1 W5	words, retelling main events and	
	22		20	iency VG Expression G	on. T2 Wk 5 - chunking new words. He is asking questions and	T2 W7	(un-, re-, dis-,) and Suffixes (-less, -ful, -	contents page
	18		20	er. Error count was high	decode at this level (18) 14/5 purpose of reading: sometimes when	T2 W7	me to think, feel or see.	I understand apostrophes
	22		20	iency VG Expression VG	Confidently chunking words. Struggling with retel of story. Does he	T1 W5	contents page	
	19		20	er.	punctuation. Said plaster for plastic. Didn't know to reread sentence	T2 W7	identifying key words in the text	scanning the cover, title and blurb.
	22		20	iency G Expression G	Didnt self-correct error. continued reasding and lost meaning. We	T1 W5	(un-, re-, dis-,) and Suffixes (-less, -ful, -	
	25		21	rd, test lower. 4/4 8-9	dont really know what else I do. If i dont know the word i can sound it	T2 W3	words, retelling main events and	
	8-8.5		21	mp FI-G Ex-G w/o IN and	him to start a sentecne again.., forgot where he was up to.	T1 W7	accurately. making complex inferences	
	21		21	er. 1/1 appl.	slow down as he reads. T2 W7 - reasing with expression and an	T3 W1	such as recognising syllables and using	(un-, re-, dis-,) and Suffixes (-less, -ful, -
	7.5-8		21	er	Reading with expressions and fleucny at level 19. stopped and	T2 W5	scanning the cover, title and blurb.	
	21		21	er, 0/1 Appl.	quesiton about the text. Tried her at level 25. Couldnt chunk the	T3 W1	contents to get information.	I can identify what the key words are.
	20		21	I Infer	Confident to decode at level 19. Reads with expression.	T1 W7	contents to get information.	
	21		21	er. 1/1 Appl.		T2 W7	I can identify key points in a text	(un-, re-, dis-,) and Suffixes (-less, -ful, -
	20		21	I Infer.	characters. responded to exclaimation mark. 14/5 purpose for	T1 W5	scanning the cover, title and blurb.	
	21		21	er. 1/1 Appl.	characters speaking. 3/8 used great expression. used new words	T2 W7	I can identify key points in a text	(un-, re-, dis-,) and Suffixes (-less, -ful, -
	21		22	Infer, 1/1 Appli	reread for sense when he had missed sight words. Could chunk the	T1 W5	(un-, re-, dis-,) and Suffixes (-less, -ful, -	
	8-8.5		22	3 8-9NF Hippos. This level	meaning. didn't know that care was not car.	T2 W5	reading fluently at this level.	contents page
	22		22	her. 8-9NF Hippos test	read with expression with talking.	T2 W3	using the text and other resources.	and contents page

Figure 5. Literacy tracking sheet showing detailed notes, goals, and achievement levels.

The maintenance of these systems was seen as problematic at times by Tama and Kate, especially when it came to keeping anecdotal notes around informal parent meetings. As Tama commented, "we keep information, like if Kate spoke to a parent she'd write it down … but if you get overrun with things and you miss that and then a parent comes in you know, that's a shocker". Kate echoed this, reflecting "we have both forgotten, we've been expecting to see it and if it's not there – it's hard". They both acknowledged that when their days became busy, finding the time to note this information down digitally could be a challenge and was sometimes missed.

Both teachers were mindful of the challenge for each to hold information about 60 students as opposed to a standard class of 30. Digital tracking systems have been put in place to ensure ease of shared access:

> If we're letting parents know you can approach both of us about your child, we have to make sure we both know all that information, and our tracking … allows us to instantly pull that information up.
>
> (Kate)

These systems therefore have multiple roles to play, not only do they inform the teaching and learning taking place but they are also used to advise parents of their child's progress. They make use of digital technology to communicate what is happening in the classroom directly with parents through Facebook and an online sharing platform called Seesaw, where students post examples of work or learning experiences for parents to view and comment on.

Case study 2 – student-to-student

The ability to make critical choices around the use of digital technology was very evident in an example shared by Amber, when discussing one of the students. She explained:

> When he's working with a group he doesn't like a device with him, he just likes to be able to talk because he feels that he can contribute better that way - but if he's got a device he kind of focuses on that, like *oh how do I get that from there again*?
>
> (Amber)

Amber also noted that when students were initially in a digital space they would always reach for digital technology as the best tool to complete a task, but that this had changed over time. She felt that allowing the students to come to this understanding themselves was important, so "they realised themselves actually this isn't right, it takes me so much longer … actually pen and paper might be the best" (Amber). Amber explained that students had become more reflective of their digital technology use over time through being given the freedom to explore, make mistakes and learn from these.

The students listed cloud based systems such as Google Docs and Google Slides as being commonly used in collaborative tasks. They discussed that these systems could be shared with all members of a group

and that they all could be on the system at the same time, “other people are all on at once and basically like so we’re all collaborating and sharing our ideas” (Georgia). Information about the upcoming week is pushed out to students each Sunday via Google Classroom. This includes group tasks and the weekly timetable which has links to resources they will need. An example of this can be seen in Figure 6.

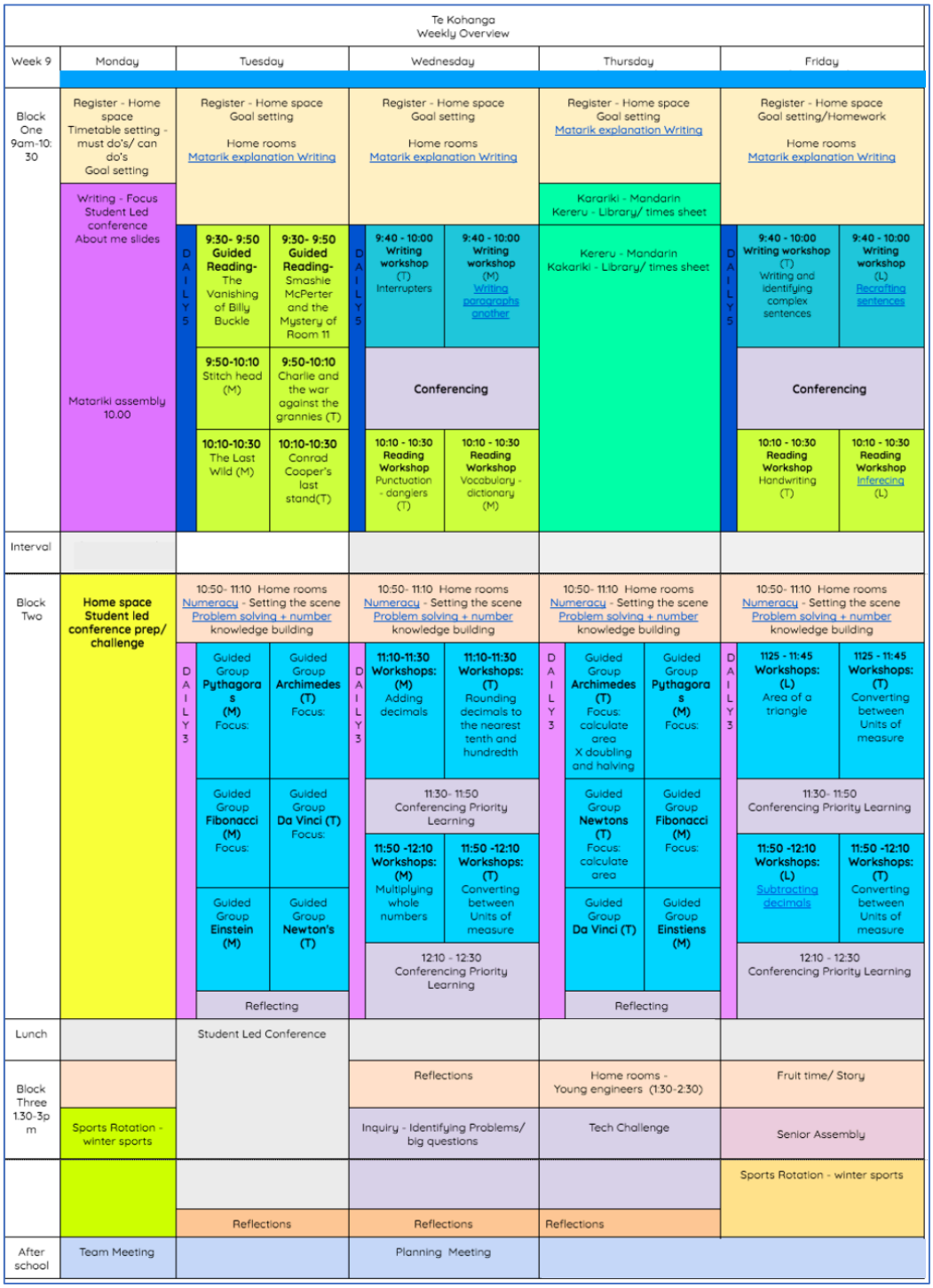


Figure 6. Example of weekly timetable shared with students.

Each student is able to adapt the timetable to their needs, for example, highlighting workshops they will be attending or adding in specific learning tasks they have chosen.

Amber saw digital technology as an enabler of collaboration, but stressed the need for students to discover for themselves which devices or applications might be best suited to a particular task. She recalled a time where some students wanted to use a particular iPad app to collaborate on a task which she knew would not offer them the best outcome:

> As much as it hurt to just watch them trying to do that, it was like if I tell them that, take that learning away from them how are they actually going to know that if they are collaborating together that's not the best app to use?
>
> (Amber)

Amber felt that developing skills around how to use digital technology was important before critical choices could be effectively made. She expressed that low digital technology skills, such as, not knowing how to use a new application on an iPad, or how to control a Sphero robot - could actually make collaboration difficult for some students. Amber explained that she had often seen students focusing on how to *use* the digital technology – rather than getting involved in the collaborative task. She therefore placed importance on giving students time to explore digital devices and new applications in order to gain confidence, because "if they haven't got the skills it can become a barrier since they are so focused on the technology" (Amber). The use of exploration time was evident in my observation of a robotics lesson where students were given the group task of creating a track/map for their robot to travel along. Some groups created these tracks on the carpet using chalk while others used text books and dictionaries (see Figures 7 and 8).

Figure 7. Robot track created with dictionaries.

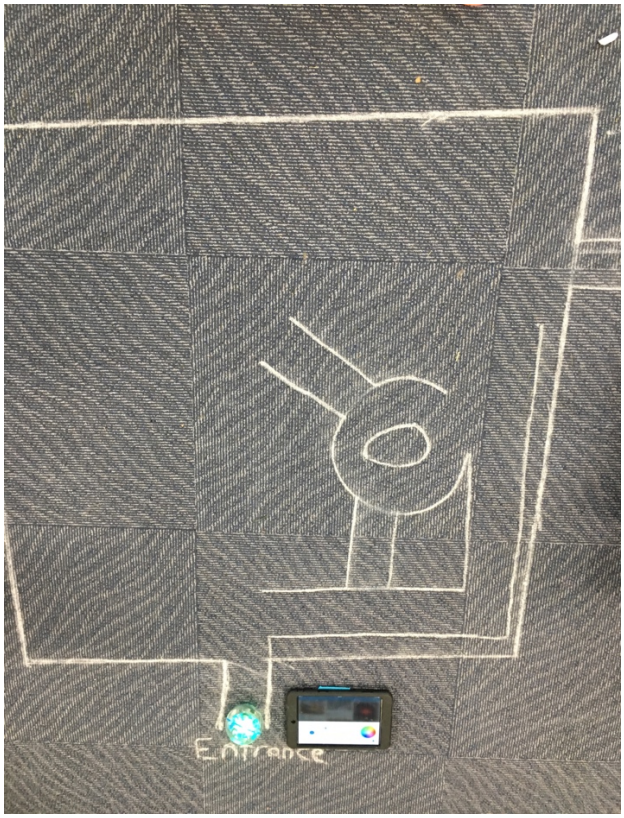


Figure 8. Early stage of robot track created with chalk.

This was one of their first sessions with these robots and they were encouraged to explore the applications that could code the robots and to attempt various commands such as jumps and turns. They then shared their learning, discussing strategies they developed and how they solved problems with controlling the robots. Figure 9 shows the task the teacher had set the students, which while flexible in that the students could choose the design of the track/map and how they would specify the tasks the robot had to do, also had structure to it which focused the students on the technical skills the teacher wanted them to develop.

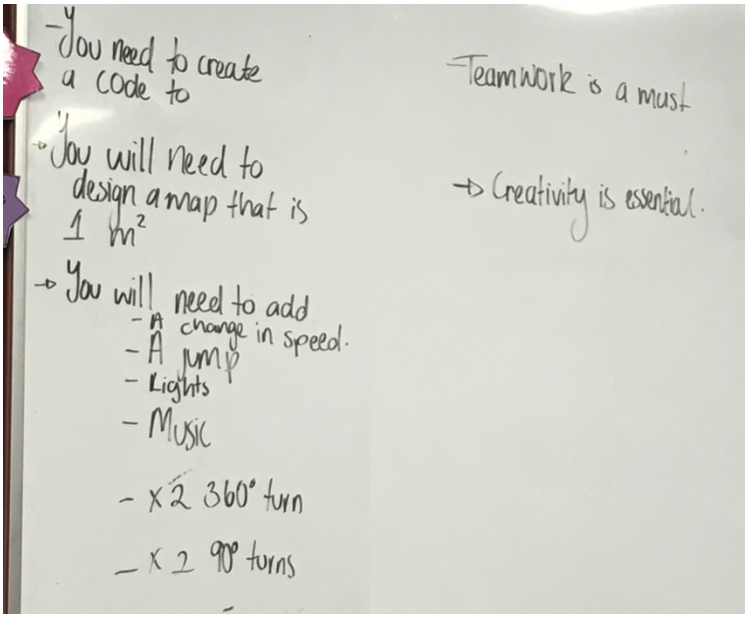


Figure 9. Robotics task assigned to groups.

Collaborative tasks are designed with both structure and flexibility in mind. An example of this is shown in Figure 10, where a dance task was set for the students. My observation of this lesson showed a wide range of dances being created, and moments of skill development in both collaboration *and* digital technology. Students could be heard encouraging others to participate, building on each other's ideas, and problem solving digital technology-based issues, such as how to add music to an iMovie.

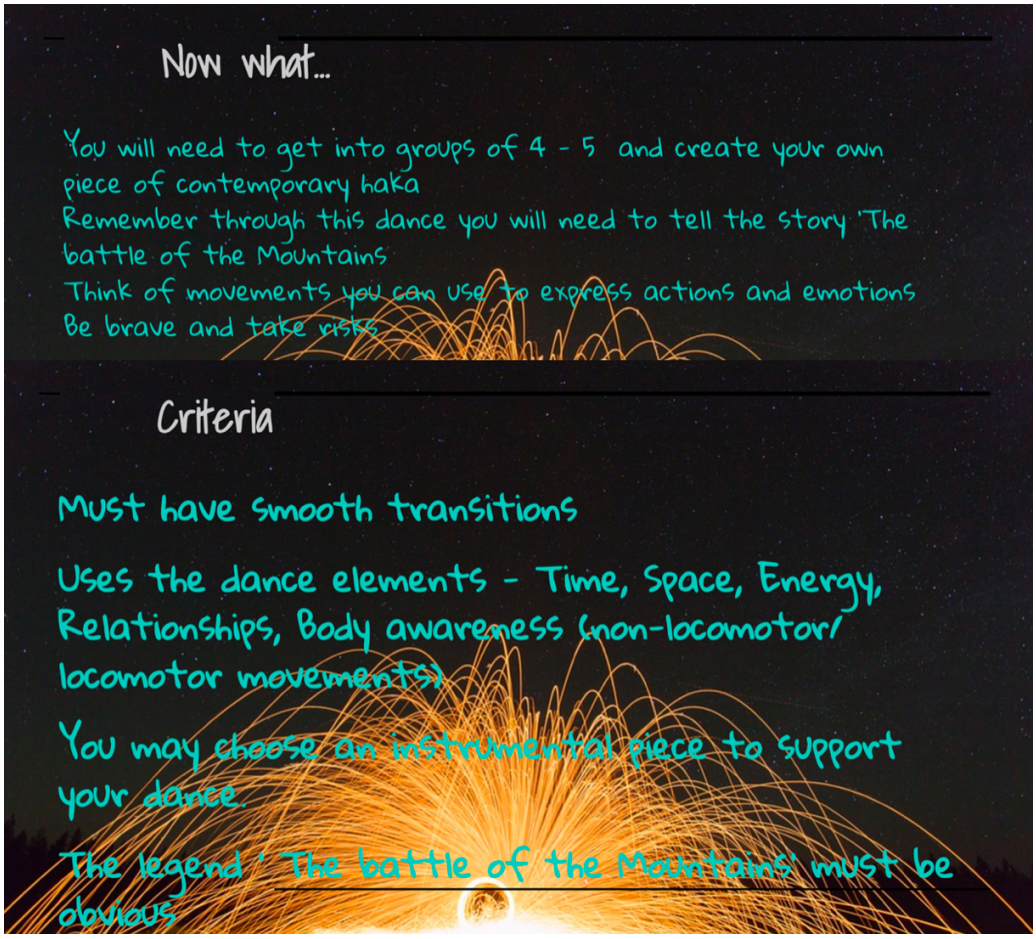
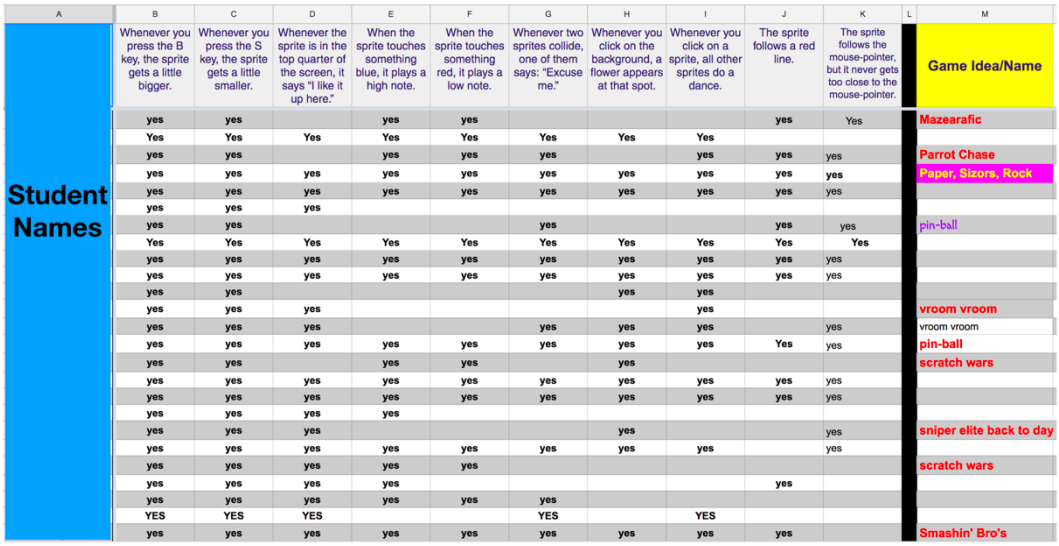


Figure 10. Dance lesson task and criteria.

Case study 3 – teacher-to-student

Digital resources were shared with students including homework, task-related items, recorded lessons, and an online writing programme called Night Zookeeper. *Google Suite* applications are particularly well used by teachers and students as these "allow multiple users to view and edit the same piece of work" (Emma). Students enjoyed that they could easily work with other students and their teachers using these applications, explaining how "Miss A, she could just add a comment on our Google slide then at the same time we could still work with her" (Siena). The interactive white board is also a favourite of the teachers because, "you can write, flip back and forth, and also you can save things to use in another lesson" (Ana).

When working with groups, Ana and Emma would use Google Forms and Sheets to get feedback or information from their students: “you can set up a Google Form and that data can get sent straight back as a spreadsheet and you can instantly see … well look, that kid there” (Ana). This information was then able to be used to plan next steps for the group or for individual students. Depending on the purpose of the data, the students could also use the information themselves to track their progress or identify experts. An example of this was a tracking spreadsheet (see Figure 11) used with a group of students learning basic coding skills through completing set tasks.



	Whenever you press the B key, the sprite gets a little bigger.	Whenever you press the S key, the sprite gets a little smaller.	Whenever the sprite is in the top quarter of the screen, it says "I like it up here."	When the sprite touches something blue, it plays a high note.	When the sprite touches something red, it plays a low note.	Whenever two sprites collide, one of them says: "Excuse me."	Whenever you click on the background, a flower appears at that spot.	Whenever you click on a sprite, all other sprites do a dance.	The sprite follows a red line.	The sprite follows the mouse-pointer, but it never gets too close to the mouse-pointer.	Game Idea/Name
Student Names	yes	yes		yes	yes				yes	Yes	Mazearafic
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
	yes	yes		yes	yes	yes		yes	yes	yes	Parrot Chase
	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	Paper, Sizors, Rock
	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
	yes	yes	yes								
	yes	yes				yes			yes	yes	pin-ball
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
	yes	yes					yes	yes			
	yes	yes	yes					yes			vroom vroom
	yes	yes	yes			yes	yes	yes		yes	vroom vroom
	yes	yes	yes	yes	yes	yes	yes	yes	Yes	yes	pin-ball
	yes	yes		yes	yes		yes				scratch wars
	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
	yes	yes	yes	yes							
	yes	yes	yes				yes			yes	sniper elite back to day
	yes	yes	yes	yes	yes	yes	yes	yes		yes	
	yes	yes	yes	yes	yes						scratch wars
	yes	yes	yes	yes					yes		
	yes	yes	yes	yes	yes	yes					
	YES	YES	YES			YES		YES			
	yes	yes	yes	yes	yes	yes	yes	yes	yes		Smashin' Bro's

Figure 11. Coding task tracking sheet

This sheet was utilised by both the teachers and the students while one of my observations was taking place; the teachers used it to monitor where students were at and who needed support, while the students were using it to select a peer who could help them with a task they were finding challenging. This also provided teachers with basic evidence of each student’s learning in relation to the coding tasks. During my observations, Ana used this base documentation to ask students for more detailed evidence, in this case, the actual coding task that the student had completed. Students were aware of the requirement to show evidence of

their learning, and appeared to be very eager to do so and share their achievements with her.

The ability to give relevant feedback was seen by the teachers as a key benefit of using digital technology to collaborate and communicate; “you can give feedback really specific to that task without waiting for them to finish” (Emma). Giving feedback was a skill they also wanted to develop in their students and this was deliberately modelled through using the online writing platform, Night Zookeeper, so that students could learn to give feedback to each other. Ana also shared a moment when a student from another class unexpectedly came to thank one of their students for the feedback they had been given. She shared how “we showed children the types of feedback that teachers give … we now expect them to do that for each other ... but it’s become across the syndicate now!” (Ana).

Students also spoke to me about the importance of feedback; “if you need help like straight away, then it’s there … they give you comments and advice” (Hera). Receiving feedback was viewed as positive by the students and they acknowledged its role in improving their learning. Lucy liked that “they can give comments to make our writing better and better so it’s like improving our writing”. James then explained that it wasn’t just the teachers who gave feedback, adding that the students themselves could do this, as illustrated by his comment, “on Night Zookeeper you can give people comments on their writing to help them improve”. Figure 12 shows an example from the online writing platform, Night Zookeeper, showing specific feedback given *by* students to another student about their piece of writing.

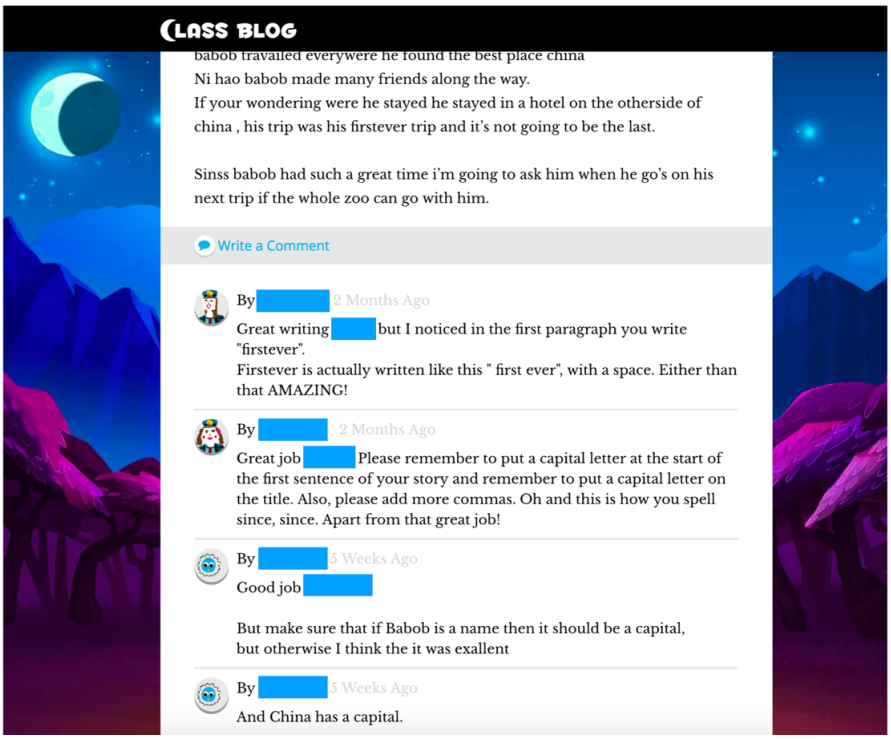


Figure 12. Screen shot from Night Zookeeper website showing student feedback.

When asked to give examples of times they collaborated with their teachers using digital technology, students mostly discussed being given feedback and asking for technical advice, or shared examples of collaborative tasks set by the teachers. James shared “we were on Google Slides and I wanted to know how to put in a circle, and I went to the teacher and she showed me”. Siena gave an example of how the teacher could give feedback, “so like if I’m the teacher and Hera makes a spelling mistake but she doesn’t know it and I’m on at the same time as her I could comment on it, and then she could fix it”.

3.3. Subtheme 7: It’s My Turn Now

It’s My Turn Now, presents data relating to how students view collaboration using digital technology, the impact of access, and how they view their individual contributions to digitally-supported collaborative tasks. This subtheme only contains data from the case studies involving students (case studies 2 & 3), but is included as I believe it contains interesting and

in places unanticipated findings which have an impact on the results of this study.

Case study 2 – student-to-student

While working in groups was a common experience for these students, some data suggested students sometimes focused on the individual contributions made to the collaborative tasks, both in the knowledge shared, and in their use of digital technology. When discussing the information on a digital slide, Molly explained, “this is my idea, that’s his idea and this is other people’s ideas”. There was also a feeling from some students that they had to be directly involved with the device to be collaborating; “its working together because everyone’s on it at once” (Georgia).

When asked about the difference between collaborating around one device or multiple devices, there was a preference for working on multiple devices. The school in this case study had a rule where only the owner of the device is able to use it, meaning the use of one device for collaboration would result in only one student being in physical contact with the device. If only one device was able to be used, the concern was then centred around everyone have a turn. Riley explained, “if you’ve got one device it might be someone’s own device and then you can’t like really do anything, cause they’re the only one that allowed on it”. David then expressed his frustration, commenting that, “they’re our own so then you can’t say *it’s my turn now* and then type something, only they are allowed to do anything on it!”.

When asked if having a school-owned device would make a difference to collaborating around one device, Georgia felt that “it would make it harder cause everyone would be wanting to touch it”. Anahera focused on taking turns, suggesting that “you could just go around in a circle taking turns, you just need to like - make rules”. Riley felt that there could be issues

with people taking ownership over the work when it was their turn, but “it’s easier for them to be able to delete it if you’re working on one iPad, they could easily just tap one button and they could delete your stuff”. There was a strong feeling from the students that everybody had to have a turn to share their ideas, but it appeared important to them that their turn involved direct contact with the device.

The students showed an awareness that collaboration involved interacting closely with others, but when asked about the use of digital technology in collaboration, they gave examples which both supported and contradicted this perspective. Georgia shared how “you can like make a slide and then you can share it with other people, then you can both put your thinking down and work together”. Later in the interview she indicated that the sharing of digital documents could also be a problem, as illustrated in her remark, “hey look, I did this but I haven’t shared it with you because you’re deleting it so I decided I would just come and show you” (Georgia). There was a sense of individual ownership over her input into the collaborative work, and a need to identify this contribution to another person.

Case study 3 – teacher-to-student

When asked about using digital technology to collaborate, the majority of students thought it helped a lot, but had mixed feelings in regards to using multiple devices or sharing one device. Jack preferred working collaboratively on multiple devices - justifying this by explaining, “if you share and have two devices you can just quickly change what you need to change, but instead if you had one device, you’d have to grab the device and do it then”. By contrast, Siena thought working with one device was better because it allowed for more discussions around choices relating to the task, meaning “you could decide together … and quickly change it”.

There was a focus within both preferences on the need to take turns when collaborating, with all students agreeing that this was important. When

Siena suggested that using one device would just require each student taking turns, some of the other students expressed that this would lead to boredom as they waited for their turn. They explained that multiple devices allowed them to all have turns at the same time, but also added that it was important for there to be open communication while doing so. This perspective is reflected in the following data:

> **Caleb:** If we were in this group and we all have a device and we can all do changes to it and then if you had to you can talk to each other.
>
> **Lucy:** yeah, I agree with that cause if you all have a device…
>
> **Caleb:** you can talk to each other…
>
> **Lucy:** you can talk to each other and say I don't really like it, can we delete it or can we not delete it.
>
> **Jack:** or could we find something else that everyone likes.

The teachers, Ana and Emma, voiced some concerns that digital technology could enable collaborative tasks to become more like cooperation when students each had their own device; "you're in a silo, you're working together but you're not actually being collaborative" (Ana). Emma agreed and explained, "you're not having those difficult conversations because you're kind of in your own little world". They agreed that they saw richer discussions when students were sharing a device, "there would be a couple of them around a laptop or whatever and that was where the discussions were happening" (Ana).

4. Summary

This section has presented data from three case studies relating to teacher and student understanding of collaboration, and the role digital technology might play in collaborative practice within innovative learning environments. Findings were presented under two main sections, one

focused around teachers and students views of collaboration, and the other on how digital technology is used to support and enable collaborative practice.

In terms of how teachers and students view collaboration, findings indicated a similar *understanding* of collaboration from both groups – essentially, that it involved people working together towards a common goal. Taking the time to build trusting relationships, where challenging conversations could be had, was seen as an important element of collaborative practice. Data also indicated that specific skills were required for effective collaboration – especially those relating to communication. There was recognition that working collaboratively involved establishing a shared understanding about the purpose of the collaboration – and a shared responsibility towards achieving this. Finally, data suggested that successful collaboration required the development of a positive learning culture – a place where teachers and students were both seen as *teachers*, able to learn from each other and utilise each other's strengths.

In relation to how digital technology was used to support and enable collaborative practice, data indicated that flexibility of time and space was important. Findings suggested that digital technology was able to change the way the teaching and learning spaces were used - this included the ability for collaborative groups to work without the traditional constraints of time and space. Data also indicated that the collaborative use of digital technology required teachers and students to be reflective, to view the technology as a tool which could be used in a range of approaches, to help them achieve their teaching and learning goals. Lastly, the data pointed to students' preference to work on multiple devices when collaborating with others – to ensure they each *had their turn*. The following chapter discusses the significance of the interpretations arising from these data, and their relationship to the research questions.

Chapter Five: Discussion

1. Introduction

The research aim of this study was:

To explore principles underpinning the development of collaborative learning environments in three primary schools, and any role digital technologies play in establishing and sustaining these.

This aim was underpinned by the following research questions:

1. What are teachers and students' understandings of collaboration, and how is this established in their classrooms?

2. Do teachers and students consider digital technology plays a role in establishing and sustaining this collaboration, and if so, how?

3. How do teachers and students consider digital technology-supported collaboration influences teaching and learning in their classrooms?

The study was conducted through an interpretive lens, utilising a collective case study methodology involving three primary schools. The three case studies differed in their foci; case study one looked at teacher-to-teacher collaboration, case study two centred on student-to-student collaboration, and case study three focused on teacher-to-student collaboration. Data was collected from observations, interviews, and artifacts. Thematic analysis was used to interpret data gathered across all three cases - with seven subthemes emerging from this process.

This chapter is structured around those seven subthemes and discusses the significance of key findings reported in Chapter Four. In keeping with the previous chapter, the subthemes have been placed under two main theme section headings: *teachers' and students' views of collaboration*;

and, *how digital technology is used to support and enable collaboration*. These themes and subthemes will be reintroduced in more detail at the start of each of these sections. Findings from each subtheme will be discussed in detail, as they relate to the research questions. The implications arising from these findings will also be detailed.

2. Section A – Teachers' and students' views of collaboration

This section focusses on teachers' and students' views of collaboration and how this presents in practice. The following discussion explores findings relating to the first question of this study:

- What are teachers and students' understandings of collaboration, and how is this established in their classrooms?

Data responding to this question will be explored by discussing the following subthemes*:*

1. *Building Collaborative Relationships* - this encompasses the importance of building positive relationships and the need for honesty and trust;
2. *Skills for Success* discusses data relating to the specific skills that are required for successful collaboration, including communication skills, compromise, and the ability to have challenging conversations;
3. *We're All in This Together* discusses data relating to having a shared understanding and joint sense of responsibility towards the teaching and learning taking place in the classroom;
4. *Developing A Culture of Learning* discusses of data related to all members of a classroom viewing themselves as both teachers and learners, acknowledging and making use of each other's strengths.

Before looking closely at findings that arose about teacher and student views of collaboration, I will discuss how participants understood the term itself. It was important to establish this in order to have a clear understanding of how collaboration was perceived by the teachers and students, and to see if this was *visible* in practice. Data showed that there was consistency across the case studies regarding to teachers' and student's perceptions of collaboration. Their understanding is broadly defined as *people working together and using their skills to achieve a shared outcome that they couldn't have achieved on their own*. These results were in line with current literature about collaboration, as reviewed in Chapter Two, which viewed collaboration as people working interdependently, moving towards creating shared knowledge and understanding, allowing for differences, and discussing key issues as they arise (Cho, 2015; Correia, 2015; McDougall, 2010).

2.1. Building Collaborative Relationships

This section is focused on data from the subtheme *Building Collaborative Relationships*, which encompassed the importance of building positive relationships and the need for honesty and trust. The findings in this study suggested that building relationships is an important element of successful collaboration, and calls for the development of trust in each other – which can take time to establish and maintain. Findings also indicated that the development of collaborative relationships can be challenged by moments of conflict, but that this conflict can benefit the relationship if a high level of trust is present. Possible implications of these findings on educative practice will also be detailed.

The teachers in all three case studies spoke of the importance of trust when working in a collaborative manner. Trusting other people to contribute to the collaborative relationship was highlighted, as well as having trust that their own contribution is valued by other team members. This concept of mutual trust has been recognised by researchers as a key element to successful collaborative relationships, and can result in people

being more willing to work in group settings in the future, and the achievement of better outcomes for students (Ennen, Stark, & Lassiter, 2015; Tolmie et al., 2010; Willis, 2014).

While the students did not mention the concept of trust directly, they acknowledged the importance of being able to work well with a range of people. Some students also stated that they chose to move away from others if they found those people challenging to collaborate with. This could be indicative of a lack of trust as people can be reluctant to work closely with each other if trust is low, whereas in a high trust situation people are more willing to share ideas and take risks (Tschannen-Moran, 2014). Alternately, it could indicate that the students were lacking the confidence or ability to communicate their frustrations to the other student(s). In reality it could be a mixture of both elements. Roschelle and Teasley (1995) refer to this ability to use communication to resolve conflict as *repairs,* where "participants in talk can deal with problems or troubles in speaking, hearing, or comprehension of dialogue"(p. 78). They go on to note that unsuccessful *repairs* lead to a further breakdown in mutual understandings over time.

Data from this study suggested that time is important in building collaborative relationships - both in the sense of having enough time to collaborate, and also in making the most of the time available. Teachers in all case studies spoke of having deliberately put time and effort into forming relationships with each other and their students, as well as structuring activities to build relationships between the students. This was evident in the rotation of group members where students had the opportunity to work with everyone in the class. Taking the time to build trusting relationships can lead to what Reina (2006) refers to as *transformative trust.* This is a stage of relational trust where people actively seek to develop trust in each other, and if that trust is broken, it is repaired quickly.

According to DuFour (2011), spending time *wisely* is key to effective collaboration. In other words, simply providing the time needed to collaborate may not lead to improved outcomes if that time is not spent on the right work. Data suggested that *the right work* includes building relationships, especially when those relationships are new, difficult, or going through challenging stages. An example in this study is when Ana (case study three), shared that she deliberately tried to connect with students she referred to as *harder to reach*, explaining that it was only then that relationships could start being built. The data indicated that a willingness to spend time on building relationships will assist in working through moments of conflict.

While forming collaborative relationships can be challenging at times, data suggested that those challenges could also be seen as an essential part of the relationship development. Some students in cases studies two and three found conflict challenging, and some would choose to move away from students they found difficult to work with. However, other students spoke of the importance of challenging each other's thinking. The challenge of conflict was viewed as an essential element of a collaborative relationship by the teachers in Case Study One. The results indicated that the ability to work through moments of conflict were assisted by the trust that has been built up over time, creating a safe environment to air concerns and work through problems. It could also be suggested that experience of working through conflict in safe environments better enabled individuals to face conflict again. Of interest, Bradley, Postlethwaite, Klotz, Hamdani, and Brown (2012) have suggested that when conflict exists within an established climate of psychological safety, performance and creative output have been shown to increase.

2.1.1. Implications

The findings from this study have indicated that the building of relationships is fundamental to successful collaboration. Opportunities must be deliberately created and time set aside for teachers and students

to work alongside each other, initially to get to know each other and build trust. Once this trust has been established, more complex and challenging collaborative experiences – such as the ability to deal with conflict – may have a higher chance of being successful. A challenge of doing this within innovative learning environments could be the larger number of teachers and students, with potentially more time being required for trusting relationships to form. This could imply that allowing teachers and students to spend more than a year together would support the development of these relationships.

While building collaborative relationships through time, trust, and conflict is important - of equal importance is taking the time to develop the skills required to build this trust and manage any conflict. The following section therefore looks at the data relating to the skills needed for successful collaboration.

2.2. Skills for Success

This section discusses data relating to the subtheme *Skills for Success*. Included in this was data relating to the specific skills required for successful collaboration, including communication skills, compromise, and the ability to have challenging conversations. Data suggested that the ability to communicate clearly with others is a key skill needed for collaboration. It was identified that within the skill of communication there existed the need to compromise and negotiate. The data also implied that the ability to face both knowledge-based and relational challenges was required. Implications of these findings on practice are also noted.

Communication skills have a major role to play in successful collaboration. Data indicated that not only do people need to clearly articulate their own thoughts, but they must equally be willing to listen to the thoughts of others. One of the teachers felt that this ability to both speak and listen needed to be explicitly taught, and that many students did not have the

required skills – making collaboration difficult for them. While Correia (2015) noted that collaboration can build communication skills, data suggested that a basic skill level must exist to enable collaboration to occur in the first place – and can then continue to be developed through further collaborative experiences. This interrelationship between communication and collaboration was evidenced in a study by Christie, Tolmie, Thurston, Howe, and Topping (2009) looking at enabling teachers to improve the quality of collaborative interactions between students in Scottish primary schools. They found that collaborative dialogue was improved through the development of communication skills, and the ongoing opportunity to use these in a range of group activities (Christie et al., 2009).

Data also indicated that working with others can require individuals to compromise on their own ideas and negotiate when needed - which can require challenging conversations. Kurylo (2010) argued that collaboration and compromise are two separate issues, whereas the data from this study suggested that they are also connected. One teacher spoke about compromise not necessarily meaning *giving away* your own ideas, rather it was about making those ideas better by being willing to adapt them. The ability to compromise was evident when students spoke of needing to recognise that *their* ideas might not necessarily be the best, and in asking for each other's opinions at different stages of a task – and making changes accordingly. Based on the data, there appears to be a clear relationship between collaboration, compromise and negotiation – that is, in order to collaborate with others, you may need to compromise – and this requires a willingness to negotiate.

The ability to negotiate with others when working collaboratively was evidenced in data collected from both teachers and students. There was an understanding that things would not necessarily go your way, and that your ideas wouldn't always be the best ones and could be improved upon through collaboration. An example of this was students negotiating on a

maths problem offering their solutions, but also asking others what they thought and if they had anything to add to the proposed idea.

Barron (2003) noted that collaboration requires individuals to address and grow "a content space (consisting of the problem to be solved), and a relational space (consisting of the interactional challenges and opportunities)" (p. 310). In a study looking at how collaborative interactions influence problem-solving outcomes, it was found that a reluctance to negotiate within either of these spaces obstructed the ability of students to be able to reason with each other – leading to an inability to solve the problem (Barron, 2003). This ability to negotiate at both a content and relational level was also observed throughout this study, with the two concepts appearing to converge at times as individuals discussed content quite robustly - but with a respect for relationship. An example of this was a planning session between two teachers where their relational trust seemed to help overcome differences in opinion, and resulted in what they saw as a better outcome for them and their students.

Findings pointed to the ability to face both relational and knowledge-based challenges as being an important element of effective collaboration. A part of this included the willingness to let go of insecurities and take risks - which was evidenced in data collected from both teachers and students. One of the teachers noted that your insecurities can hold you back when working in a collaborative setting - if you let them. Figner and Weber (2011) defined risk- taking as "the result of both deliberate and affective evaluations of available choice options" (p. 213), also noting that the underlying motivations for risk-taking need to be acknowledged. In other words, risk-taking behaviour is driven by the individual person, their understanding of the situation, the choices available to them, and also by *why* they were willing to take a risk. One student spoke of the cyclic nature of working through challenges, noting that new experiences would have repeated moments of frustration followed by moments of celebration – her comments indicated that she was willing to take the risk to try again.

This finding suggested that experiencing, and reflecting on, the positive outcomes of risk-taking may make individuals more willing to take risks in the future.

The importance of reflection was also evident in the data collected in this current study. A teacher commented that collaborative challenges offered individuals the chance to reflect on their own practice and that personal growth could be difficult if you were unwilling to do this. Lockhorst, Admiraal, and Pilot (2010) conducted a study in the Netherlands looking at teacher training programmes – specifically focusing on the collaboration of 41 student teachers. Results of the study indicated that opportunities to be critically reflective led to increased participation in collaborative tasks and deeper levels of communication

2.2.1. Implications

These findings have implications for practice. In order for collaboration to take place, the ability to clearly communicate with others must be developed. Reflection is vital here, there needs to be a level of self-awareness, an understanding of our own ability to speak clearly and confidently, and a willingness to listen actively to others. The data suggested this needed to be explicitly taught to both teachers and students in order to be successfully used in practice. Findings also indicated that collaboration requires the ability to take risks, negotiate with others, and potentially compromise on our own ideas. This would suggest that we need to create the opportunities and environments for our teachers and students to practice doing just this.

Development of these skills is important, but collaboration also requires teachers and students to understand *why* they are collaborating and to develop a shared vision around the *purpose* of a collaborative task. The following section is centred around this need for a shared understanding.

2.3. We're All in This Together

The subtheme *We're All in This Together* is the focus of the following section. This subtheme contains data relating to the notion that teachers and students working in a collaborative setting need to have a collective understanding regarding the learning they take part in, and how *they* function together as a team. The findings from this data indicated the importance placed on developing a shared understanding of the collaborative work being undertaken, its purpose, and the need for all individuals to be actively involved. Implications for practice will be discussed in relation to those points.

Findings across the three case studies pointed to the value placed on having a shared understanding when collaborating with others. In the case of teacher-to-teacher collaboration, there was a strong focus on the students in the classroom – all decisions being centred around them and their needs. This student-centred approach is viewed by researchers as being a natural fit with collaborative teaching and learning, requiring a shared understanding or vision by those involved (Istance, 2010; Prestridge, 2012; Wong et al., 2008). Additionally, the data indicated that through mutual misunderstandings, the teachers established the need for clarity around how their classroom functioned – including not making assumptions that they had a shared understanding.

The data also suggested that some students were driven to achieve a shared understanding due to pre-set expectations around the purpose of a task – in particular, the fact that they would be sharing what they had learnt with others. In regards to this, findings also indicated that students were conscious of the negative impact of not sharing the correct information, for example, the possibility of misunderstandings due to incorrect information being passed from person to person. This notion of being accountable was explored by Stein, Colyer, and Manning (2016) in relation to student peer assessment for collaborative tasks. Evidence suggested that this can increase accountability levels – which can in turn

stimulate learning. I suggest something similar has occurred here. Students knew they were accountable for understanding the learning taking place because they would have to share this learning with others – therefore they were more likely to be actively involved.

The need for active participation from all individuals engaged in the collaborative task was another key finding. Students spoke of helping each other to complete tasks, and that everyone should try their best. Additionally, teachers created tasks that required participation and contribution from all – an example of this being the coding task spreadsheet in which teams were asked to reflect on tasks completed and their next steps as a group. Heflin, Shewmaker, and Nguyen (2017) identified active participation as a key element of student engagement – in other words when students are engaged with a task, they willingly take part because they want to – not because they have to. Additionally, Niemi and Multisilta (2015) noted that opportunities to collaborate increase learner engagement and motivation. This was reflected in observations of both teachers and students who, when fully engaged in a task, appeared to be actively involved in the discussions and actions taking place. Specific examples of this were in the collaborative planning of a literacy programme by teachers, and the group-based maths coding activity being worked on by students.

2.3.1. Implications

There are several implications for educators that can be taken from these findings. Firstly, with increasing number of teachers working in collaborative teaching spaces, we need to ensure that time is given for teams to create a shared understanding of collaboration and what the teaching and learning will look like in their space. This shared understanding (or what may be referred to by schools as a shared vision) also extends to the students – who need to know what collaboration looks, sounds and feels like, in order to recognise when it is or is not occurring. Secondly, both teachers and students would benefit from having a shared

understanding of any task they are working on in collaboration with others – and continue to keep in mind the *purpose* of that task. The final implication is that of engagement and how to enable this - again for both teachers and students. If we want teachers and students to actively involve themselves in collaborative relationships and tasks, they have to *want* to be involved. A way to achieve this could be direct involvement in the construction of learning experiences, allowing individuals to have more ownership over what they learn, when they learn, and how this learning needs to look.

Findings in this section have suggested that having a shared understanding of the purpose of collaboration, as well as being actively involved in the collaborative process, is of value to teachers and students. The following section focuses on data related to creating a culture of learning that enables this shared understanding to develop, and that helps build the collaborative and relational skills highlighted in the preceding sections.

2.4. Developing a Culture of Learning

Data from the subtheme *Developing a Culture of Learning* is discussed in this section. This subtheme comprises of data connected to individuals viewing themselves as both teachers and learners, and the creation of a positive collaborative learning environment. Findings from this data point to the importance of developing a culture of learning which enables and supports collaboration. Acknowledging individual strengths and weaknesses, and learning from these is viewed as essential – with all individuals being seen as teachers as well as learners.

The need to develop a positive culture of learning was reflected in data collected in this study. Findings indicated that teachers and students viewed learning from each other as a natural part of their world, and that a collaborative environment offered opportunities for individuals to take on

the role of both teacher and learner. Of interest is that this was happening regardless of the combination of people – teachers were learning from each other and from their students, and students from each other and their teachers. Observations showed interactions were quite fluid - with individuals moving between the roles of teacher and learner depending on the stage or context of the task. This was illustrated by a teacher who spoke of working with a group of her students to help in another classroom, when one of those students confidently stepped up into a teaching role – even though he had not anticipated doing so. Another example was during a coding session when students were approached by their peers for help with specific coding skills – they would pause their work with one group to help the other, and then refocus back to what they were originally doing.

This study pointed to the need to draw on the strengths of others, and to share your own strengths, as a key element of the learning cultures built in these classrooms. This thinking fits with research around the changing work environment – where people are increasingly expected to work closely with others and to draw on each other's strengths (Cho, 2015; Soulé & Warrick, 2015; Trilling & Fadel, 2009). This current study showed recognition from both teachers and students that individuals have different skills to offer, and data suggested they felt combining those skills led to higher levels of success than working individually. Teachers spoke of how recognising these strengths in each other had given those students who struggle in core learning areas a chance to shine and feel valued.

Working with others and utilising each other's strengths can be linked to a social constructivist perspective of teaching and learning, where individuals should be engaged in tasks which would prove challenging to finish independently (Schreiber & Valle, 2013). The notion of individuals achieving greater than expected progress through interacting with more able peers is illustrated by what Lev Vygotsky called the Zone of Proximal Development (ZPD). Vygotsky believed that the level of development of a

learner should not be determined by what they could do *today*, rather by what they could do *tomorrow* – viewing new learning functions as "not fruits yet, but buds or flowers of development" (Vygotsky, 1935/2011, p. 204). It is of interest to note that when one of the teachers reflected on how much he had learned through collaborating with his more experienced co-teacher – he saw this as a reciprocal concept. He spoke of gaining new skills and understandings from his time with her, but that the collaborative relationship also gave him the opportunities to refine his own skills as he supported her learning through his own strengths.

2.4.1. Implications

The findings from this subtheme have implications for how educators view teaching and learning in a collaborative space. The need to create a positive culture of learning – where individual strengths are celebrated and used to upskill others, is an important element of achieving successful collaborative outcomes for teachers and students. Recognition needs to be given to the broad range of skills that people bring to a classroom - and that given the opportunity, these skills can develop further through collaboration. There is a growing necessity to view each individual as both a teacher and a learner – and also for them to view themselves in that way. This requires challenging the mind-set of educators who have more traditional views of their role, and may be used to the autonomy of running *their* classroom *their* way – without consideration what other teachers or the students themselves could offer.

While the previous subthemes related to the teachers' and students' understandings of collaboration and how this looks in practice, the following section brings in the element of digital technology. This is still viewed through the lens of collaboration, but is focused on the application and impact of digital technology.

3. Section B – How digital technology is used to support and enable collaboration

This section continues to focus on collaboration, but looks at this in association with digital technology – namely, how digital technology is being used by these teachers and students to support and enable collaborative practice. The discussion addresses the following research questions:

- Do teachers and students consider digital technology plays a role in establishing and sustaining this collaboration, and if so, how?
- How do teachers and students consider digital technology-supported collaboration influences teaching and learning in their classrooms?

Subthemes coded under *How digital technology is used to support and enable collaboration* include:

1. *Anywhere, Anytime* encompasses the flexibility that digital technology offers its users in regards to time and space - including the notion of being able to *rewind* learning;
2. *Critical Choice* contains data concerned with the critical and strategic use of technology by both teachers and students to enable and enhance collaboration;
3. *It's My Turn Now*, explores the notion of how students view collaboration using technology, the impact of access on collaboration, and how students view their individual contributions to collaborative tasks.

3.1. Anywhere, Anytime

This section discusses data from the subtheme *Anywhere, Anytime.* This subtheme concerns the flexibility that digital technology offers its users in regards to time and space. It also includes the notion of being able to *rewind* learning - whether at home or at school. The findings that emerged from these data suggests that collaboration is supported by digital

technology's ability to be used in a range of spaces and at a range of times. Digital technology's capability to be *rewound* and *reviewed* multiple times is also viewed as valuable.

Teachers and students were seen using digital technology to collaborate in a wide range of spaces in this study. The students especially made use of mobile, wireless technology and appeared to appreciate its ability to be easily moved to different locations. Devices were used inside and outside, allowing collaborative groups to work in a location that best suited them and the purpose of the task. Previous studies have also identified that students value being able to use portable devices to freely move around their learning spaces and easily interact with others (Falloon, 2015; Fisher et al., 2013). This ability to work in a range of spaces was encouraged by teachers in these case studies, who spoke of digital technology creating opportunities for students to be able to move outside of the four walls of the classroom.

Data suggested that, as well as the digital technology, the flexibility of space offered by the physical aspects of innovative learning environments (e.g. moveable walls, covered decks, mobile furniture, and a range of furniture styles) allowed groups to make strategic choices over where they wanted to work. These findings concur with other studies that highlight the impact of space in innovative learning environments. These studies noted that flexibility of space and furniture - combined with digital technology and pedagogical changes - resulted in teaching and learning moving out of the traditional classroom setting (Benade, 2016; Sullivan, 2012). Students in the current study gave a range of reasons for choice of space, including the desire to move away from others, and needing a place where they could focus.

In relation to the flexibility of space, it was interesting to note that students felt digital technology also enabled collaborative group members to be

physically independent of each other, while maintaining collaboration. Cloud-based programs, such as Google Docs, meant that students could essentially collaborate with group members from different areas of the classroom or beyond. This data proved interesting as students did not feel that they always needed to be in physical contact with other group members in order to collaborate – even when this was possible. Working in this synchronous manner is typically utilised when individuals are *unable* to work together in person, and these results were unexpected. Some students would move around the learning space, revisiting their own groups when needed, and also approaching other groups for advice.

Cloud-based systems were also well utilised by both teachers and students outside the typical school day. Students used cloud-based systems, emails, and Facetime to continue working with their peers regardless of whether they were at home or school. While the teachers used cloud-based systems as an essential part of their classroom programme, for example; to plan, track, and communicate, findings from this study indicated that the main benefit they saw was the ability for them to work in different spaces. Systems were put in place to better enable this, such as the colour coding system used by Tama and Kate (case study one), allowing them to clearly see when an agreement had been reached regarding planning for the following day.

While data suggested that Tama and Kate (case study one) valued digital technology's ability to enable them to collaborate without being in the same space, it also showed they felt that their most powerful collaboration happened in person. The technology – while still utilised – was viewed as a fairly invisible part of these collaborations. Findings indicated this speaks in part to the student-centred approach these teachers take to their collaborative relationship, and the importance they place on having critical conversations regarding the teaching and learning occurring in their classroom. These results suggest that while digital technology can offer flexibility in regards to when and where teachers can collaborate, it may

not fully replace the benefits of collaborating in person. In revisiting the skills required for successful collaboration noted in Chapter Two, I propose the data pointed to most of these skills being more effectively developed and maintained in person. Those skills include:

- exchanging ideas clearly;
- respecting different points of view;
- encouraging discussion;
- negotiating;
- listening to others;
- displaying tolerance;
- managing projects.

(Cho, 2015; Cole & Stanton, 2003).

A search for studies around the concept of virtual collaboration found limited results in the classroom context, however, interesting findings have come out of work-based studies. While virtual teams showed greater efficiency in brainstorming, project planning, and setting goals, the development of the relational aspects of collaboration such as building trust and morale, and managing conflict were more efficient within in-person teams (Labrosse, 2008; Lepsinger & Derosa, 2015). This is consistent with why these teachers felt that collaborating in person, and being able to have those critical conversations, was most effective.

Another finding this study made in relation to the use of cloud-based systems was connected to time. Teachers and students would access shared documents in either a synchronous (same time) or asynchronous (different times) manner, according to need. This afforded them flexibility of time, meaning they could contribute to shared documents at a time that suited them - and this didn't necessarily need to line up with other group members. Data also showed the assumption some students made on being able to contact their teachers at any time, with a strong expectation about relatively quick feedback – as, according to those students, teachers

are usually on their devices outside of normal school hours. The concern here is the possible increase in workload, and a blurring of the lines between work and home lives. Given that an increased workload is often noted as a reason for teachers leaving the profession (Kelchtermans, 2017; Lindqvist & Nordänger, 2016), the perception students have of contacting their teacher at any time is a possible area of concern.

The last element in the subtheme *Anywhere, Anytime*, looks at the *re-windable* capacity of digital technology. This term is not limited to the notion of rewinding such as related to a video, but it also includes the idea that digital devices allow access to any number of items which can be viewed, copied, recrafted - in other words, *rewound*, many times over. This study demonstrated that digital technology allowed collaborative groups repeated access to items such as timetables, set tasks, resources, and to their own digital creations. Teachers felt this offered students more agency over their learning as they could control what they needed to re-view or seek clarity on. As part of their follow up work, groups of students were observed watching pre-recorded lessons, and checking co-constructed brainstorms. They were also seen *rewinding* their own creations, reflecting on these against digital copies of set criteria, and making improvements. Teachers flipped back and forth between digital items while working with groups, reminding students of past learning, as well as editing and refining students' ideas collaboratively. One teacher shared that students could, and did, access these shared digital items over and over again – both at school and at home.

The ability to *rewind* learning using digital technology has been greatly enhanced by: improved internet capabilities, more powerful software, wireless portable devices, and more recently; the increase in cloud-based systems which have allowed freedom from servers, and can be used by multiple platforms (Rollag & Billsberry, 2012; Young, 2016). This was reflected in the case study schools, where a range of portable devices

were being utilised, with a strong reliance on cloud computing to store and share items.

There is a growing trend across many sectors of education to use a *Flipped Classroom* approach. *Flipping the classroom* involves core lessons being viewed by students prior to working with the teacher, with classroom learning becoming centred around problem solving and collaboration with peers (Boevé et al., 2016; Della Sciucca & Fochi, 2016). While this approach shares similarities with findings from this study - given that students can watch pre-recorded lessons - these were lessons the students had already taken part in. The data suggested that the use of digital technology in this study included aspects of the flipped classroom (collaboration, problem-solving, recorded lessons) but also much more. Teachers and students were able to control their own access to digital content and use this when and where it was needed, reflecting the importance of learner agency in these spaces.

3.1.1. Implications

The data collected under the subtheme *Anywhere, Anytime* has clear implications regarding how digitally-supported collaboration can influence teaching and learning. This study pointed to the importance of flexibility. Digital technology can give collaborative groups the ability to work in a range of spaces - spaces which best suit their learning style and the requirements of the given task. Our classroom environments need to offer flexibility in terms of the physical environment as well as the learning that occurs in these. The technology also needs to be flexible enough to work *with* the environment – meaning strategic choices need to be made over the type of digital technology being used. Another implication arises from the notion of time, and the expectations of students being able to contact teachers at any time. My own experiences are consistent with these findings, therefore I suggest that after hours communication via digital technology is an issue that needs addressing, with clear boundaries put in place.

The ability for digital technology to be *rewound* also has implications. If we are asking students and teachers to work collaboratively we need to make use of systems which support this. Learning tasks need to be designed to utilise digital technology's ability to be *rewound*. We need to be promoting the use of systems and applications which are easily accessed, shared, and able to be worked on collaboratively. This study pointed to the importance of teachers and students being encouraged – and perhaps even expected – to use digital technology in this manner.

As digital technology becomes easily accessed anywhere and at any time, and collaboration becomes more prevalent in our schools, it is important for teachers and students to make strategic choices regarding the types of digital technology they use and *how* they use them. The following subtheme, *Critical Choice*, discusses this point in more depth.

3.2. Critical choice

This section is focused on data from the subtheme *Critical Choice.* This subtheme includes data concerned with the critical and strategic use of digital technology by both teachers and students to enable and enhance collaboration. Findings from the data suggested that the collaborative use of digital technology requires users to be critical of how they are using the technology in practice, ensuring that its use is strategic, flexible, and reflective – including within the design of the collaborative tasks themselves.

Research has shown that digital technology is no longer used to merely transfer information from the teacher to the learner (Cicconi, 2014). In fact, recent studies have shown that the successful integration of digital technology into the classroom requires an understanding of *how*, *when*, and *why* digital technology can be used to improve teaching and learning outcomes (Chandra & Mills, 2014; Scalise, 2016). The focus here, as with the findings from this study, is on the students – not the technology. This

student-centred approach to digital technology use is espoused by many teachers, however, researchers have also identified a mismatch between a teacher's beliefs and how they actually use digital technology - leading to recommendations that these mismatches be addressed (de Aldama & Pozo, 2016; Ertmer et al., 2012). Findings from this study suggest that a match between beliefs and actions becomes even more critical when teachers are working collaboratively – with two belief systems at work.

Data indicated that digital technology use was driven by the needs of the teachers and students across all three case studies. Teachers explained that digital technology could enhance opportunities for collaboration, allowing them to turn their visions for learning into reality. For example, timetables were shared with students, and these were able to be personalised by each student – fitting with the teachers' vision for developing student agency. Another example were the tracking systems put in place by teachers. This supported them in achieving a shared understanding of where all their students were in their learning. It was interesting to note that some teachers saw their digital technology use being a result of their collaborative relationship and the needs that arose from this – rather than their needs being driven by the technology.

Cloud-based systems were most commonly used by teachers and students due to their ability to be used in both a synchronous and asynchronous manner. Data indicated that there was a clear purpose to the use of these systems in supporting collaborative practice. Examples of this included: teachers and students using Google Sheets to plan and to track progress; Google Classroom to push out planning, share and access resources, and gather student work; and teachers using Google Forms to collect information and feedback from students. In terms of feedback, teachers and students both noted the benefits offered by using digital technology in this area. These benefits included being able to give and receive *specific, timely feedback*, even being able to do this in real time - while a task was still being worked on.

Viewing digital technology as a *tool* to enable learning was identified as an important element of successful integration. Correia (2015) defines a tool as "a device created to perform or facilitate a manual or mechanical task" (p. 3), adding that we can view digital technology in the education context as a *tool for learning*. Additionally, and in fitting with the context of this study, research has widened this view to include digital technology as a tool for sharing work and collaborating on problems (Fisher et al., 2013). Teachers across all three case studies spoke of wanting students to develop an awareness of digital technology as a *tool for learning*, and for them to understand which tool best suited them or the task they were working on.

One teacher shared her frustration at watching some students choose a particular iPad app which she knew was not a suitable tool for a collaborative task, however she felt it was important for them to discover this themselves – which they did. The data suggested the ability to make strategic choices develops over time, and with experience in digital learning environments. This also includes not choosing to use digital technology at all. Research seems to support this finding. For example, Heflin et al. (2017) discussed the possibility that students who were familiar with digital technology focused more on the task rather than the technology. Additionally, Ciampa (2014), who carried out research on motivators for digital technology use, found that the more agency learners had over their technology use, the more informed choices they made. This research, alongside the data from this study, suggests that when an environment has been created in which students have agency, are able to take risks, and clearly see digital technology as a tool, the ability to make critical choices improves.

In regards to the critical use of digital technology for collaboration, one teacher explained that exploration time was essential before critical choices could be effectively made. She felt that if students were unfamiliar with the digital technology it could have a negative impact on collaboration

due to the increased focus on how to actually *use* the technology. However, it was interesting to note that many of the exploration opportunities observed in this classroom were carried out in collaborative groups, but with the main focus on technological skills rather than collaborative (see Figure 11, Chapter Four). This again highlights the importance of having a clear purpose for learning, and on the role digital technology will play. It also suggests that a potential benefit of collaboration would be in the joint technological capabilities present within a group – meaning individuals who have more experience with a particular digital tool can support others, which was observed throughout this study in relation to both teachers and students. While the data set in relation to this was small, it is significant given the rapid changes in digital technology and the increasing role of collaboration in our classrooms.

3.2.1. Implications

The findings connected to the subtheme *Critical Choice* have clear implications concerning the role digital technology can play in collaboration. The first is the requirement for teachers and students to have time to explore digital technology in order to become familiar with the possibilities it offers as a collaborative tool. Purpose is once again a key element here, and while collaboration may be the desired outcome, at times the building of technological skills might need to be supported by a collaborative task – as opposed to the technology supporting collaboration.

Additionally, findings have indicated that it is important for teachers and students to develop the ability to reflect on their use of digital technology – viewing this as a learning tool and taking risks with its use. However, it is also important to reflect on the choices they make and whether those choices are fit for purpose – in particular, questioning how the tool supports and enables collaboration. The use of cloud-based technologies which are easily accessed and shared, appears to be a key element for enabling collaboration, and therefore should be well utilised.

The final implication here is the need for a student-centred approach to the collaborative use of digital technology. In regards to collaborative teaching partnerships, this encompasses the planning, tracking, and communication systems put in place, but also includes developing tasks to challenge and grow individual students technological *and* collaborative abilities.

This focus on a student-centred approach leads naturally to the final subtheme of this section, *It's My Turn Now,* which contains data centred around the students only, and their views on digitally supported collaboration.

3.3. It's My Turn Now

It's My Turn Now, explores how students view the collaborative use of digital technology, their role in the collaborative process, as well as the impact digital technology access might have on these views. While students in this study appeared to have a clear understanding of what collaboration should look like, findings also indicated that in practice they focused on each having their own turn using a device. Data indicated that students viewed direct physical interaction with the device as essential to collaboration, and like to note their own contributions to a task. Findings also suggested that most students preferred having their own digital device when working on a collaborative task. This subtheme contains data from only two of the case studies but were included in the findings as, while unexpected, they proved interesting and relevant to the research questions.

Data indicated that the students in this study understood collaboration as: *people working together on a task and utilising each other's strengths to achieve outcomes they could not do individually*. However, when discussing the use of digital technology in collaborative practice, some findings arose that appeared to contradict elements of this perspective.

Some students were focused on individual contributions to a collaborative task, rather than joint. Examples of this included one student who pointed out the individual parts of a task that group members had added to a Google Slide, and another who raised concerns over group members deleting *her* contributions.

There was also a clear preference shown for having their own device to work on. The over-riding reason for this appeared to be the enabling of students to easily contribute their ideas. When asked about the ability to do this by sharing one device, most students felt that when they each had their own device they could all contribute at the same time. The data indicated students viewed waiting to use a device a waste of time, with a student expressing that everyone would be bored waiting for their turn. Only one student voiced that sharing one device was better – reflecting that it created more opportunities for groups to discuss any changes they wanted to make. Other students agreed that while discussions were an important part of collaboration, these could still be conducted while working on their own devices. The data did show that some teachers displayed a preference for shared devices, noting that while they recognised students preferred using multiple devices, richer discussions were seen when students were sharing. They also voiced the concern that working on individual devices resulted in a task becoming cooperative rather than collaborative.

This study suggests that, when using digital technology to collaborate, some students did not feel they had contributed unless they were in direct contact with the device. Of added interest here is the fact that one of these schools has established a rule regarding student owned devices - where only the owner of a device is able to be in direct contact with it. Several students raised this as an issue for collaboration, noting that this limited who could be on the device to one person, and made physically taking turns with the device impossible. Data therefore appeared to

indicate that, in the eyes of the students, this type of rule (while possibly aiming to ensure the safety of the device) created barriers to collaboration.

This finding is significant as studies have identified an increasing number of schools establishing a Bring Your Own Device (BYOD) policy, in part due to the increased availability of mobile digital technologies, the decreasing cost of these, as well as their ability to foster engagement and collaboration (Maher & Twining, 2017; Mills, 2014). While there is insufficient research available to indicate how common it is for these schools to include rules around the use of a device by other students, it was interesting to note the promotion of collaboration as a benefit of BYOD.

It is well documented that digital technology can be viewed as an enabler of collaboration when educators move away from its previously individualised use and create the right conditions for collaboration (Cicconi, 2014; Ertmer et al., 2012; Resta & Laferrière, 2015). These data have indicated that one of these conditions might be the ability for *all* students to have shared access to *all* devices – however, it is acknowledged that this could be a challenge for schools to implement and parents as key stakeholders would need to be consulted.

Based on findings, one could suggest that some students may prefer working in a cooperative manner - which has been noted as being easier for children than collaboration (Kozar, 2010). However, the desire to take turns and to acknowledge their own contributions may not necessarily indicate they *weren't* collaborating. Davidsen and Vanderlinde (2016) conducted research indicating that students needed to be shown *how* to collaborate and also *why* they need to collaborate – and data from other subthemes explored in this study suggests the students *did* know this.

To explore this further requires reviewing the definition of collaboration established from the data: *people working together and using their skills to achieve a shared outcome that they couldn't have achieved on their own*. Findings presented above indicated students' actions and understandings were reasonably consistent with this definition: they were observed taking part in rich discussions and making agreed upon changes to group work; there was an understanding that they all needed to be directly involved in the task and be able to share their learning outside of the group; and, they drew on and acknowledged each other's strengths throughout.

3.3.1. Implications

The findings from this subtheme have clear implications for both practice and policy. Teachers need to ensure that their students have a clear understanding of what collaboration involves, and that they are also clear on the purpose of a collaborative task. There was also an indication that some students place importance on their own contributions to a collaborative task. It seems key then that teachers acknowledge this need for individual recognition, yet also build the students' capacity to recognise and celebrate joint contributions. One solution could involve setting group-based criteria for collaborative tasks (including their use of digital technology), which could assist students to focus on group contributions - rather than individual.

While most students in this study preferred using their own device when collaborating, teachers indicated that students sharing a device produced richer collaborative discussions. Data suggested that there may in fact be a place for a combination of shared and individual devices – depending on the purpose and complexity of the task. For example, groups of students were seen using one device to create with, and another to gather information, or check criteria. Teachers must therefore ensure that students have clarity regarding *how,* and *why,* they are choosing to use particular digital technologies to complete collaborative tasks. Access to the available digital technology is important to students and affects the

choices made, with access to *all* technology allowing for seamless transference of devices between collaborators.

In regards to students wanting to have access to all available digital devices, the concept and nature of BYOD programmes needs to be considered. Again, a key element to define here is *purpose*, what exactly is the purpose of students bringing their own devices to school? If the ability to collaborate *is* desired, then it would be beneficial to define exactly what is meant by collaboration – including *digitally-supported* collaboration - and ensure school BYOD policy enables this definition to work in practice. Consultation with parents, as well as educating them on the schools vision for digitally-supported collaboration, will be required.

4. Summary

In summary, this chapter discussed findings relating to the aim of this study, that is:

To explore principles underpinning the development of collaborative learning environments in three primary schools, and any role digital technologies play in establishing and sustaining these.

The findings have indicated that the teachers and students in this study generally have a common understanding of collaboration, when evaluated against the definition presented in the introduction. They collectively viewed this as: *people working together while utilising each other's skills to achieve what they could not do alone*.

The development of trusting relationships was seen as a key element in enabling collaboration, with the recognition that these can take time to establish, and often involve working through moments of conflict. Communication skills were seen as a vital element in the building of trusting collaborative relationships, this included the ability to actively listen, and clearly express opinions. These skills, alongside the ability to

negotiate, were viewed as important, due in part to the increased need to compromise when working with others. In practice, collaboration was seen as requiring high levels of self-awareness, including the ability of an individual to reflect on their (and others) contributions in regards to the progress and outcomes of the tasks undertaken.

Teachers and students considered having a shared understanding of the purpose of any collaboration important. This shared understanding enabled *clarity of purpose* about what they wanted (or needed) to achieve in order to complete a task, and was best supported by active involvement and engagement. There was also a level of accountability to others noted - for the teachers this was to each other, their students, and their parents; for students it mostly centred on accountability towards the *shared understanding* expectations set by the teacher, but also to the other students they may need to share their learning with.

It was established that creating a classroom culture where all individuals were seen as teachers and learners helped support involvement and engagement, in turn creating conditions where collaboration could thrive. The recognition and utilisation of individual strengths was seen as a key part of building collaborative relationships. This focus on individual strengths allowed students and teachers, who might struggle with particular learning areas, the opportunity to shine – and to see their skills as beneficial to others. A strong culture of learning also saw individuals fluidly moving between the roles of teacher and learner depending on the learning context. A social constructivist view of teaching and learning was prevalent here, with collaborative activities allowing people to learn from more able peers, achieving more than they could do alone.

In regards to the role digital technology plays in collaborative practice – data indicated it can help establish and sustain collaboration in a range of ways. Findings pointed to digital technology being viewed as a tool for

collaborative learning - it was used for planning, tracking, sharing, creating, collecting work, and for feedback. This was mostly made possible due to the use of cloud-based systems such as Google Docs, which could be worked on collaboratively - in both synchronous and asynchronous fashions. Teachers were reflective in their use of digital technology, adapting resources as required, and also supported their students to take this reflective approach. Additionally, students were encouraged to take risks in its use, and benefited from having time to explore the possibilities offered by certain technological tools, often learning from their peers during this process.

While the digital technology acted as a tool to establish and sustain collaborative practice, it did so with a level of invisibility, meaning it was not the direct focus of the teaching and learning. Some teachers noted that collaborating in person was their initial preference, with digital technology supporting the outcomes of that collaboration. All teachers were clearly focused on how the technology supported them in addressing the needs of their students. Interestingly, for the students it was important for them to have *physical contact* with the device, to have *their turn to contribute* – resulting in a preference for using their own device. It was not certain whether this need to have *their turn* resulted from a desire to use the device, or if it was simply a means to ensure *their* contribution was recorded. This focus on being able to physically use a device when working collaboratively raised questions around the shared use of personal devices and how this is regulated through a schools BYOD policy.

This study has indicated that the collaborative use of digital technology influences the way teaching and learning is able to occur. Teaching and learning has been able to move away from the four walls of the classroom, and beyond the school gates. There is a level of flexibility in relation to time and space which did not previously exist. No longer are teachers or students constrained to working on a shared project at the same time, or

in the same physical workspace. They also have the ability to *rewind* teaching and learning – meaning that students and teachers can re-view tasks, lessons, resources, and even their own creations. This allows them to refine their understandings and work at a pace that best suits them.

Data has also shown that the physical classroom environment has been influenced by digitally-supported collaboration. The increase in wireless capabilities and ease of mobility means devices are able to be used inside and outside traditional learning spaces. Flexibility is again a key feature in how these spaces are now required to function, and instead of a *one size fits all* approach, the spaces need to have multiple functions. Furniture therefore needs to be easily moved around these spaces ensuring that groups are able to work in a space that suits their needs, instead of having to adapt to the environment itself.

The next chapter will discuss the significance of these findings, recommendations for educators, suggestions for further research, and also addresses the limitations of this study.

Chapter Six: Conclusion

1. Introduction

This study set out to explore principles underpinning the development of collaborative learning environments in three primary schools, and any role digital technologies play in establishing and sustaining these. The study was established in response to my own teaching experiences, as well as the current direction being taken throughout New Zealand education – namely the promotion of 21st century skills, digital technology, and innovative learning environments. Research was conducted through an interpretive lens, aiming to understand teachers' and students' interpretations *from within their own settings*. The study was undertaken using a qualitative methodology within a collective case study framework, utilising interviews, artifacts, and observations to collect and triangulate data. Thematic analysis was then used to examine the collected data - with seven subthemes emerging from this process.

This chapter addresses the significance of key findings that have emerged from the themes, linking these to the three supporting questions of this study (see Chapter One). Following this discussion, recommendations for educators will be made, limitations noted, and areas of future research suggested.

2. Summary of study

This study has shown that effective collaboration requires the individuals involved to have a shared understanding of what collaboration means to them, and what it looks like in practice. *Clarity of purpose* is important - this encompasses understanding the purpose of the collaboration, their own role within this, and the role digital technology will play. Establishing and maintaining this shared understanding calls for strong communication skills. Teachers and students need to be actively involved in the collaboration, and able to share their ideas and listen to others. They

must be willing to come to a compromise when differences of opinion arise, and have the skills to successfully negotiate through challenging conversations. Findings suggested that these challenging conversations can be supported by the establishment of trusting relationships. While these relationships take time to develop and maintain, the benefits to collaboration appear extensive. Trusting relationships can enable and support teams to work through conflicts that arise, take risks, be accountable to themselves and others, and reflect on the outcomes of their collaboration.

Findings indicated the development of collaborative environments necessitates individuals actively working together, building on each other's strengths and balancing out weaknesses. Individuals need to be seen as both teachers and learners, utilising each other's relational, content and technological capabilities in order to complete tasks. Data suggested the importance of recognising that everyone who is involved in a collaborative relationship has something to offer and, through the collaboration, may actually help build the skillset of other team members.

Results indicated that the use of digital technology, coupled with a collaborative teaching and learning environment, has an impact on how classroom spaces can be used. Using digital technology enabled teachers and students to work in a range of locations due to the portability of devices and their wireless capabilities. Teaching and learning spaces had multiple functions and needed to be easily adapted to the demands of the users. The flexibility of time and space offered by digital technology enabled collaborations to occur anywhere, at any time, and also meant team members could work in *different* times and spaces, independent of each other. This flexibility of time allowed students to contact their teachers when desired, including outside of school hours, leading to a growing expectation that teachers would in turn quickly respond.

Digital technology also offered flexibility in how digital content was used. Teachers and students were able to *rewind* content for both teaching and learning purposes. Lessons, resources, created work, and planning, were able to be viewed and then re-viewed as often as required – allowing collaborative teams to work at their own pace. While teachers indicated a preference for having students share devices when collaborating, multiple devices were often employed by groups to support their collaborative requirements.

The findings indicated that having a clear purpose regarding digital technology use is paramount – taking into consideration *how* it allows the collaborative vision of the team to be achieved. Digital technology was viewed as a tool to support the desired outcomes of collaborative teams and was used in a predominately reflective manner. This reflective use appeared to grow alongside the technological skills of the users, with teachers indicating that allowing time for technological skill development was critical. Additionally, viewing digital technology as a collaborative tool appeared to result in a level of *device invisibility* in the eyes of skilled users, with collaborations centered around the task rather than the technology. Students collaborative use of digital technology also appeared to be influenced by a desire to have their own voice heard, and they indicated that achieving this involved *having their own turn* via direct contact with the technology being used.

3. Recommendations for educators

An interpretive paradigm was used in this study, and findings are based on the interpretations of teachers and students from three primary schools, meaning results are not necessarily transferable to other contexts. However, it is my belief that recommendations can still be suggested for educators who are exploring collaborative pedagogy /digital technology/ innovative learning environment blends.

Schools looking to explore the benefits of digitally-supported collaborative teaching and learning need to establish a shared vision of what collaboration means to them and how they see it working in practice. *Clarity of purpose* is essential, teachers and students need to feel confident regarding the purpose of any collaborative relationship or task, and be clear about the role they play in this. This may require developing criteria around expectations, and will develop further through experience. They also need to be clear about the purpose of using digital technology, ensuring its use is enabling, rather than inhibiting, collaboration. Collaborative teaching and learning is centered around learning with and from others. Teachers need to establish classroom environments where students' individual strengths are recognised and utilised – a place where they and their students move fluidly between the roles of teacher and learner.

Teachers and students must be afforded the time to build trusting relationships. If collaboration means teams are sometimes required to work through challenging situations, they need to feel comfortable and safe to do so. This may have implications for how collaborative teaching teams and classrooms are established, perhaps advocating for individuals to spend more than a single year together to draw on the relationships previously established. The notion of time also needs to be shown respect by those in a collaborative relationship regarding work/life balance – especially at the beginning when systems and relationships are being developed. Teachers and students need to ensure that the ability to use digital technology to collaborate outside of normal school hours is balanced with consideration of an individual's commitments outside of school. Time is also recommended for teachers and students to build their technological skills, the aim being for digital technology to become less visible in collaboration, possibly allowing users to better focus on relational or task requirements.

Classroom environments must adapt to the needs of their users. The physical space should have multiple purposes, suggesting that traditional

classroom compositions may not support the flexibility afforded by digitally-supported collaboration. If learning is able to take place anywhere and at any time, the space surrounding that learning must allow for this. Students may initially need encouragement to take their learning outside of the physical classroom, and be made aware of the ability to work on collaborative tasks outside of traditional school hours. This also implies that the learning tasks must be designed to take advantage of this flexibility of time and space. Additionally, tasks should be designed to demand collaboration. It is important to look closely at the authenticity of the task, at whether it will provide students with a challenge that they will have to work through *together* in order to achieve success. The use of success criteria and group reflections - based on collaborative skills and outcomes - needs to be considered.

If collaboration is a driving point for digital technology use, schools must also consider their BYOD policy. The fluid use of digital technology ideally requires *all* students being able to access *all* devices, therefore this needs to be reflected in policy - which sometimes limits use to the owner of the device. The type of device used in schools also impacts on the ease of sharing, with some digital technologies, such as Chromebooks, purposefully designed for multiple users. Given that parents may be reluctant to allow personal devices to be shared, schools need to consider educating them on how devices are used and the role they can play in collaboration. If parents are made aware of the purpose of sharing devices, asking permission for this as part of the user agreement may result in a greater number being able to be used. Additionally, it may be that the schools themselves can also provide a number of devices for each class to better enable collaboration.

There are also implications here for teacher education institutions. If schools are now encouraged to create innovative learning environments where digitally-supported collaboration is expected, and where teachers are increasingly working in co-teaching teams, beginning teachers must be educated about these. The traditional concept of having one associate

or mentor teacher will also need reconsideration as student and beginning teachers are placed in co-teaching teams.

4. Limitations of study

There are some limitations to this study. Firstly, it only involved three classrooms and these were spread across three schools. This small sample size limits the generalisations that can be made. The limited time frame also dictated the amount of data that was able to be collected and therefore captured a snapshot of understanding rather than tracking changes in understanding through experiences, or being able to unpack understandings in more detail. It was also difficult to link the overall study context to other research, mostly due to the relative new blend of digitally-supported collaboration and innovative learning environments.

Finally, I need to acknowledge myself as a limitation to this qualitative study. While care was taken when collecting and interpreting findings by using triangulation and reflexivity, these were still subject to interpretation through my own knowledge and understanding of the topic.

5. Future Research

This study has highlighted several possibilities for future research.

1. The motivation for students to collaborate appeared to be mostly driven by accountability placed on them by the teacher. The scope of this study did not allow further exploration of the influence of accountability on a student's desire to work towards a shared understanding. It would be interesting to explore this further and consider how to shift accountability from being focused on the teacher - to self and team. Task design would be worth exploring in relation to this, namely how the design of a task can provide both the requirement *and* motivation for students to come to a shared understanding.

2. The collaborative use of digital technology coupled with BYOD policy in schools appears to create challenges regarding use of devices. Research could explore how common it is for schools to implement rules around the use of a personal device by other students, how these correspond with the school's vision of how devices should be used for collaborative tasks, and what changes may be needed to achieved a better fit with this vision.

3. Students shared their desire to *take their turn* when collaborating – focussing on being able to physically use a digital device to record their individual voice. Research looking at the motivation behind this thinking would be worth pursuing. Of consideration is whether an interest in physically using the digital device was the catalyst for the students' desire to *take turns*, or if it was simply a need to ensure their individual voice was heard. It would be interesting to establish whether the same issues would arise when collaborating with non-digital tools.

4. Given the increasing number of schools moving towards an innovative learning environment/digital technology/collaborative pedagogy blend, a larger study of this nature is called for. Expanding the study to include teachers and students at various stages of their learning journey across a wider range of schools, would offer more insight into current practice, and in turn, provide more support for educators new to this type of teaching and learning environment, and the use of digital tools within them.

6. Closing statement

The aim of this study was to explore principles underpinning the development of collaborative learning environments in three primary schools, and any role digital technologies play in establishing and sustaining these. The results suggest that establishing a shared understanding of digitally supported-collaboration, backed by the development of trusting relationships, is important. Collaborative practice

in these classrooms involved the utilisation of individual strengths and a level of fluidity between the roles of teacher and learner. The role of digital technology in collaborative practice was one of support and enablement. Digital technology was viewed as a tool to support the teachers and students in turning their collaborative visions into reality, offering them flexibility of time and space - which in turn changed the way classroom spaces could be used.

As more schools move to modernise their physical learning environments, we need to ensure that the teaching and learning taking place within these spaces is reflective of these changes. Simply placing teachers and students into these innovative learning environments, handing them digital technology, and telling them to collaborate is not sufficient. The concept of collaboration must be clearly defined. Expectations of involvement, as well as boundaries around this, need to be clearly understood and accepted by the individuals involved. *Clarity of purpose* is key, teachers and students should have a shared understanding of why they are collaborating, how digital technology could support their collaborative needs, and how they can make best use of their physical environment.

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Appendices

Appendix A: Observation schedule

Observed Actions	Participant 1	Participant 2	Participant 3
On task • **Looking at the work being developed on device.** • **Website being viewed is relevant to the task.**			
Contributes ideas • **Adds to a digital mind-map.** • **Types information onto a shared google doc.** • **Gives an opinion on which imovie theme will best suit a task.**			
Encourages participation • **Gives shared device to a group member to use.** • **Shows a group member how to use an app/programme.** • **Congratulates a group member for the photos they took.**			
Asks for clarification • **Pausing work on imovie editing to check if intended action is correct.** • **Checking to see if the website he/she has found is relevant to the task.**			
Accepts criticism • **Following a group discussion, makes changes to a section of a document that he/she had constructed but others disagreed with.** • **Accepts that a chosen transition of theirs on a slideshow is not the most suitable choice.**			

Provides criticism (about idea not person) • **Expresses concerns about information from a website not being rewritten in students own words.** • **Observes a mistake in a code written in Hopscotch and clearly explains why code will not work.**			
Refocuses group back to task • **Asks for others opinions on which music to add to imovie.** • **Reminds others of the expected timeframe for completing a digital advertisement.** •			
Relates new learning to old • **Recalls a past coding task and suggests trying a loop technique from that task for current coding task.** • **Uses a skill from Keynote to solve a problem with Google slides.**			
Listens to others ideas • **Adds another student's idea to a slideshow.** • **Agrees to try to new technique suggested by a group member for adding a repeating music pattern in Garageband.**			
Expresses emotions • **Shares that he/she is unhappy with a theme chosen for the group's digital booklet design.** • **Shares his/her pride in the group's completed Minecraft world.**			
Notes			

Appendix B: School leader information and consent form

April 3 2017

School Leader Information and consent.

The role of digital technologies in collaborative practice within innovative learning environments.

To the Principal,

My name is Leesa Mangino, I am a teacher at Leamington School and am currently on study leave working towards my Masters in Education, through Waikato University.

I am researching the role that digital technologies might play in collaborative teaching and learning, culminating in writing a thesis which will be the final step towards achieving my Masters.

The study focuses on these key questions:

1. In what ways are digital tools used for the purpose of teaching and learning collaboration in three primary schools?

2. How do teachers and students view the tools as influencing collaboration for teaching and learning purposes?

3. What do teachers and students see as the outcomes of using digital tools for the purpose of teaching and learning collaboration in their schools?

If you agree to participate, the research will require the following activities:

1. The sharing of artifacts, e.g. documents such as teacher planning, student work, and other examples that demonstrate the use of digital technologies in reflecting either the outcomes of collaboration and/or have been used as a key component of a collaborative task.

2. Observations - I will spend time with students and teachers, observing as they take part in digitally supported collaborative tasks.

3. Semi-structured interviews to be held at your school on a set date; discussing questions formed from observations and interpretation of artifacts. This should take no longer than 1 hour, facilitated by myself.

4. Focus group interviews to be held with students on a set date; discussing questions formed from observations and interpretation of artifacts. This should take no longer than 1 hour, facilitated by myself.

Student, teacher and school names will be anonymised and only pseudonyms used in any reporting. However, complete anonymity cannot be guaranteed.

Please note that participation can be withdrawn at any time and unprocessed data may also be withdrawn at any time.

A summary of findings will be provided to your school at the end of the research process. You may disseminate the findings to your school community if you choose to. Once the thesis is published, a link for viewing the research on the Research Commons will be provided. It is anticipated that the results from this study will provide useful insights to help shape future thinking and planning for New Zealand schools.

If you do agree to this, please indicate consent on the attached form, keep a copy for yourself, and return the original to me. If you have any further questions relating to any aspect of the study, please do not hesitate to contact me using the details below.

Kind regards

Leesa Mangino

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THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Research Return Form for Leaders of Schools

The role of digital technologies in collaborative practice within innovative learning environments.

I have read the information sheet and understand the nature of the research and what is required of the school and teachers involved, and I agree to the school, teachers and students participating in it. (Please indicate in the boxes)

- ☐ Data may be collected from participating teachers/students in our school via sharing of artifacts.
- ☐ Data may be collected from participating teachers/students in our school via observations.
- ☐ Data may be collected from participating teachers in our school via interviews.
- ☐ Data may be collected from participating students in our school via focus group interviews.
- ☐ Data may be analysed and findings reported for the purposes outlined, including publications or presentations.

I agree as Principal to the above and will inform my Board of Trustees before research commencement. If I have any concerns, questions, or wish to withdraw participating teachers, or the school from it, I may contact the researcher at any time.

Principal name:

Signed:

Date:

Appendix C: Teacher Information and consent form

THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

April 3 2017

Teacher Information and participant agreement.

The role of digital technologies in collaborative practice within innovative learning environments.

Dear teachers,

My name is Leesa Mangino, I am a teacher at Leamington School and am currently on study leave working towards my Masters in Education, through Waikato University.

I am researching the role that digital technologies might play in collaborative teaching and learning, culminating in writing a thesis which will be the final step towards achieving my Masters.

The study focuses on these key questions:

1. In what ways are digital tools used for the purpose of teaching and learning collaboration in three primary schools?

2. How do teachers and students view the tools as influencing collaboration for teaching and learning purposes?

3. What do teachers and students see as the outcomes of using digital tools for the purpose of teaching and learning collaboration in their schools?

If you agree to participate, the research will require the following activities:

1. The sharing of artifacts, e.g. documents such as teacher planning, student work, and other examples that demonstrate the use of digital technologies in reflecting either the outcomes of collaboration and/or have been used as a key component of a collaborative task.

2. Observations - I will spend time with you and your students, observing as you take part in digitally supported collaborative tasks.

3. Focus group interviews to be held with students at school on a set date; discussing questions formed from observations and interpretation of artifacts. This should take no longer than 1 hour, facilitated by myself.

4. Semi-structured interviews to be held at your school on a set date; discussing questions formed from observations and interpretation of artifacts. This should take no longer than 1 hour, facilitated by myself.

5. Checking and amending of transcripts - a copy of the interview transcript will be emailed to you and you will have two weeks to check and make amendments before returning the transcript. If transcripts are not returned at the end of the two weeks, it will be taken that no changes were needed and transcripts will be used as data.

Student, teacher and school names will be anonymised and only pseudonyms used in any reporting. However, complete anonymity cannot be guaranteed.

Please note that participation can be withdrawn at any time and unprocessed data may also be withdrawn at any time.

A summary of findings will be provided to your school at the end of the research process. Your principal may disseminate the findings to your school community if they choose to. Once the thesis is published, a link for viewing the research on the Research Commons will be provided. It is anticipated that the results from this study will provide useful insights to help shape future thinking and planning for New Zealand schools.

I hope you agree to your participation in this study. If you do agree to this, please indicate consent on the attached form, keep a copy for yourself, and return the original to me. If you have any further questions relating to any aspect of the study, please do not hesitate to contact me using the details below.

Kind regards

Leesa Mangino
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THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Research Return Form for Teacher Participants

The role of digital technologies in collaborative practice within innovative learning environments.

I have read the information sheet and understand the nature of the research and what is required of the school and teachers involved, I give my consent to participate in this (Please indicate in the boxes).

- ☐ Data may be collected from me via sharing of artifacts.
- ☐ Data may be collected from me via observations.
- ☐ Data may be collected from me via interviews.
- ☐ Data may be collected from my students via focus group interviews.
- ☐ Data may be analysed and findings reported for the purposes outlined, including publications or presentations.

If I have any concerns, questions, or wish to withdraw, I may contact the researcher at any time.

Teacher name:

Signed:

Date:

Appendix D – Parent Information and consent form

THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

April 3 2017

Parent/Caregiver Information sheet and informed consent.

The role of digital technologies in collaborative practice within innovative learning environments.

Dear Parents and Caregivers,

My name is Leesa Mangino, I am a teacher at Leamington School and am currently on study leave working towards my Masters in Education, through Waikato University.

I am researching the role that digital technologies might play in collaborative teaching and learning, culminating in writing a thesis which will be the final step towards achieving my Masters.

The study focuses on these key questions:

1. In what ways are digital tools used for the purpose of teaching and learning collaboration in three primary schools?

2. How do teachers and students view the tools as influencing collaboration for teaching and learning purposes?

3. What do teachers and students see as the outcomes of using digital tools for the purpose of teaching and learning collaboration in their schools?

If you agree to your child participating, the research will require the following activities:

1. Observations - I will spend time with teachers and students, observing as they take part in digitally supported collaborative tasks which form part of their normal classroom programme. Please note, no photographs of your children will be taken as part of this process.

2. Focus group interviews to be held with students at school on a set date; discussing questions formed from observations and interpretation of artifacts. This should take no longer than 1 hour, facilitated by myself.

Student, teacher and school names will be anonymised and only pseudonyms used in any reporting. However, complete anonymity cannot be guaranteed.

Please note that participation can be withdrawn at any time and unprocessed data may also be withdrawn at any time.

Information collected from your child relating to the questions above will be analysed alongside all students' data, and findings will be reported back to your school principal. Outcomes from the study will be shared in my thesis, and other possible forums such as conferences, conference papers, publications, and online education forums. It is anticipated that the results from this study will provide useful insights to help shape future thinking and planning for New Zealand schools.

I hope you agree to your child participating in this study. If you do agree to this, please indicate consent on the attached form and return it to me via the classroom teacher. If you have any further questions relating to any aspect of the study, please do not hesitate to contact me using the details below.

Kind regards

Leesa Mangino

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THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Research Return Form for Parents/Caregivers

The role of digital technologies in collaborative practice within innovative learning environments.

I have read the information sheet regarding the research planned to be undertaken at my child's school. I give consent for my child to be observed and to participate in a focus group interview for research purposes as outlined in the letter above (Please tick).

- ☐ Data may be collected from my child via observations.
- ☐ Data may be collected from my child via focus group interviews.
- ☐ I understand that data from the research may be used in a thesis, presentations, publications and other possible forums as outlined in the letter. If I have any concerns, questions, or wish to withdraw my child from the study, I may contact the researcher at any time.

Parent/Caregiver's Name:

Signed:

Date:

Appendix E: Student Information and consent form

(Case Studies 2 & 3) Student Verbal Assent Process and Written Consent form

At the start of the research I will explain the following in language appropriate to the age group of students involved.

1. What the research is about *(I am looking at how you use technology to collaborate (work together) with each other on tasks);*

2. How the information is being collected *(I will be talking to some of you and your teachers about collaborating with technology and I will be collecting some work that you have produced, I will also be watching you work in groups to see how you are collaborating and how you are using the technology when you are doing this, I won't be taking any photos of you while you are working but I will be taking notes on this sheet – here I will show them my observation schedule);*

3. What the results will be used for *(I am writing a thesis, this is a very long piece of writing all about what I find out about technology and collaboration, I may also do some presentations and tell other teachers about what I have learned, I might also publish what I find out in a magazine for teachers to read);*

4. What it means for them - what will they have to do *(you just need to do your normal group work that the teacher sets you, I will be watching how you are working together and using the technology, if I interview you it will be with other students and we will just talk about collaboration and if you think technology is useful when working with others)*

5. What they can do if they are uncertain, uncomfortable, or have any questions at any stage of the research process. *(If you don't want to be part of this study you do not have to and you can stop at any time, you just need to tell me or tell your teacher or your parents/caregivers that you don't feel like you want to do it anymore. You can also ask questions if you have them – whenever you need to)*

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Te Whare Wānanga o Waikato

Research Return Form for Student Participants

The role of digital technologies in collaborative practice within innovative learning environments.

I have listened to the researcher's explanation and understand what the research is about.

I give my consent to participate in this (Please indicate in the boxes).

- ☐ Data may be collected from me via my teacher sharing some artifacts.
- ☐ Data may be collected from me via observations.
- ☐ Data may be collected from me via focus group interviews.
- ☐ Data may be used for the thesis, presentations and other publications.
- ☐ If I have any concerns, questions, or wish to withdraw, I may ask my teachers/parents/caregivers to contact the researcher at any time.

Name:

Signed:

Date:

Appendix F: Teacher Interview Questions

Semi structured Interview Questions – teachers

1. How do you define collaboration?
2. What do you see as the key differences between co-operation and collaboration?
3. How do you ensure that collaboration is able to occur (between students, between teachers, between students and teachers)?
4. What relationship do you see between digital technologies and collaboration?
5. How do you see technology enabling collaboration between teachers/students/teachers & students?
6. What would you consider to be the benefits of working collaboratively? Does technology add to these benefits or take away from them?
7. What would you consider to be the challenges of working collaboratively? Does technology add to these challenges or ease them?
8. Can you give examples of times where collaboration was impacted either in a positive or negative way by technology?
9. What are some of the outcomes you have observed or experienced from using digital technology to collaborate – aside from the work produced? (eg skills developed, relationships, knowledge transfer)
10. How has your use of digital technology within collaborative practice changed over time?

Appendix G: Focus Group Interview Questions

Focus Group Interview Questions

1. What does it mean to collaborate with others?
2. Do you think collaboration is different to co-operation? If so, how?
3. How do you use digital technology to collaborate with other students or your teacher?
4. Does technology help you to collaborate with others or does it make collaboration harder? Can you share some examples?
5. I noticed that you sometimes use more than one device when you are collaborating with others – how does doing that help your group to collaborate?
6. How do you think using digital technology to collaborate with others helps you with your learning?
7. What are some collaborative projects you have worked on using digital technology that you are proud of?
8. What are some collaborative projects you have worked on using digital technology that you don't think worked so well? Why didn't they work?
9. Has using digital technology to collaborate with others helped you to develop new skills? If so, what skills do you think you have developed? (eg sharing ideas, asking questions, accepting criticism, problem solving)