

**Digital technologies and the senior Geography classroom:
Teachers' perceptions of the impact on teaching and
learning.**

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Abstract

With the dawn of the 21st century, there was a great expectation that a digital revolution would take place and transform the classroom. This technological change would see students take control of their learning and the role of the teacher would be transformed from a holder of knowledge to a facilitator. The premise of this research is to see to what extent this transformation has occurred, and to explore the perceptions and experiences of senior geography teachers regarding the implementation of digital technologies into senior geography. There is abundant literature relating to how digital technologies influence student learning, how they can influence pedagogy and how they can be introduced into the geography curriculum. This research study looks at these issues in terms of the current reality for senior geography teachers.

The two aims of this research are, firstly, to investigate the perceptions of senior geography teachers on the use of digital technologies in their subject and the influence of this on their pedagogies. Secondly, the research aims to investigate which digital technologies are used in senior geography, how teaching and learning have changed as a result of their use, and the implications of this for the future of the subject. This study employs a qualitative approach and follows a constructivist paradigm. Six senior geography teachers, who are currently teaching senior geography, were interviewed in order to explore their perceptions and experiences concerning the implementation of digital technologies. The stipulation was that they must have at least two years' experience in teaching senior geography. The findings were analysed through the thematic approach using a coding process to identify themes. The findings were then presented by themes in accordance with three sub questions, which were designed to meet the aims of the study and answer the main research question.

The findings showed that there were three major trends with regard to the implementation of digital technologies into senior geography. One trend concerned the digital literacy of the senior geography teachers and students, which hindered the implementation of high level digital technologies. A second trend related to the disparities in access to digital technologies for senior geography teachers and students, which had implications on pedagogy as well as affecting the potential of these technologies to contribute to the enhancement of geography as a subject. The third trend emphasised the importance of expectations from the New Zealand Qualifications Authority (NZQA), with regard to meeting assessment criteria, in influencing pedagogy. This was compounded by school policies and the expectations of senior management.

Recommendations from this study include a radical change in what it means to implement digital technologies into senior geography, changing the curriculum in order to address digital literacy, changing how geography is taught inside and outside the classroom and providing equality for both the geography teacher and student in terms of accessibility to digital technologies.

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Attestation of authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the references), nor material which to a substantial extent has been submitted for the award of degree or diploma of a university or other institute of higher learning.

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Signed:

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“There are three stages in scientific discovery. First people deny that it is true, then they deny it is important and finally they credit the wrong person” is a famous quote by the Father of Modern Geography, Alexander von Humboldt (Bryson, 2003/2016, p. 508). I hope that I will not make the same mistake, as this thesis became a reality with the kind support of many people who helped in the most diverse manner.

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Chapter One- Introduction

Introduction

On March 17th 1963, Hanna-Barbera released an episode of the Jetsons cartoon where a classroom in 2063 is depicted (Novak, 2013). The teacher was replaced by a robot, a student was watching a TV programme on devices attached to his wrists and digital weekly report tapes were issued to the students, who were sitting in rows at futuristic desks. There were some elements of a traditional classroom – books and blackboard. Yet the overriding image was one where technology had replaced the teacher. It is this image of a fully technological classroom with little need of a human teacher that has been perpetuated in media since the mid-20th century and it has contributed to a complicated relationship between digital technology and education. The idea that a fully digitalised education system is the future for 21st century education has resulted in a misunderstanding of how digital technologies should be used in the classroom.

By its very nature education is open to change, as it seeks to facilitate learning through teaching, which includes storytelling, discussion, research and training students to be able to deal with the future world. The implementation of digital technologies in subjects including Geography is a natural progression. As the use of digital technologies in the non-educational world increases, so there is an obligation of the education system to provide the students with the skills to use them, and this is where a complicated relationship develops and important questions arise. This leads teachers and students to ask themselves to what extent digital technologies should be implemented into the curriculum, what skills are in danger of being left out to accommodate digital technologies and what this implementation will mean.

With any new initiative there is a variation in how people embrace it and the same is true for the implementation of digital technologies within Senior (Years 12 and 13 in New Zealand schools) Geography classes. There are those who fully embrace it, while there are those that are more cautious for a variety of reasons, including confidence in their own abilities, personal preferences and concerns about the quality of education for their students. For Geography teachers, the implementation of digital technologies within the classroom could mean a change in pedagogy, which for some is a daunting task. These disparities can cause conflicts as some Senior Geography teachers see the implementation of digital technologies as an intrusion, while others see it as a tool which can bring effective teaching and learning experiences. In addition, Senior Geography teachers may feel pressured into using devices or they are seen as 'Luddites' (Howard & Mozejko, 2015) or 'digital immigrants' (Prensky, 2001). This study intends to clarify teachers' perceptions of these issues.

The push for fully implementing digital technologies into Senior Geography has also come from the New Zealand Government through the New Zealand Qualifications Authority (NZQA). There is an expectation that students are to become digitally aware and that digital technologies will be incorporated into the curriculum, from completing internal assessments digitally to introducing more digital external assessments each year. This will inevitably have an impact on the nature of the Geography curriculum.

NZQA are increasingly moving external moderation to be completed online, and again this will impact the nature of Senior Geography, especially with regard to geographical research and geographical skills based standards.

This push from the New Zealand and NZQA filters down to the schools, which then results in schools interpreting the requirements and incorporating them into the curriculum without regard to the implications for both teachers and students, in terms of their ability to use digital technologies and the cost. Schools are encouraged to purchase online platforms in order for the teachers and students to fully integrate the curriculum digitally. To what extent these policies are successfully implemented and how the teachers perceive them is another focus of this study.

Early in the 21st century, Prensky discussed the perception that students are 'digital natives' while teachers are 'digital immigrants'. Students, he argued, are at ease with digital technologies, whereas teachers are trying to catch up, like a migrant coming to a new country and trying to learn the language (Prensky, 2001). This image of teachers playing catch up to the students, and the view of the traditional classroom as no longer suitable to meet the needs of the students, is a common theme in the literature. Students are portrayed as being able to multitask, adapt to receiving information quickly and being able to use digital technologies with the fluency of a native, while the teacher is speaking in an outdated language which the student cannot understand. Nearly twenty years after Prensky was writing, it could be argued that some teachers are also 'digital natives' but it does not necessarily follow that they will use this expertise to significantly alter their pedagogies. Clearly, however, the notion of the difference between the abilities of teachers and students in using digital technologies is fundamental in Senior Geography, as it could influence the effectiveness of implementing digital technologies in the subject.

This study is designed to examine experienced Geography teachers' perceptions of the implementation of digital technologies within the Senior Geography curriculum, to critically examine their experiences in using digital technologies within their teaching, and to investigate how they perceive the effects of this use on their students' engagement and learning.

Rationale

The rationale for this study developed through my experiences in teaching Senior Geography for 30 years. Through my experiences, I have seen many initiatives which have been brought in to improve teaching and learning. The most significant initiative has been the implementation of digital technologies, which has had a mixed reception from teachers. The second influence is that I am of the Humboldt school of Geographers (see Appendix A), in that I am a passionate geographer, especially with regard to fieldwork and geographical skills, such as data collection and analysis, which I believe lie at the heart of the subject. Alexander von Humboldt (1769-1859), widely regarded as one of the fathers of modern Geography, believed that taking detailed measurements and observation in the field were essential to understanding the environment. His approach, therefore, emphasised the collection, recording and

analysis of data in order to acquire new knowledge. All of these skills may now be aided by the use of digital technologies.

Personal perspective

Although my parents were not wealthy and did not have a university education they were passionate about education. My mother had a fascination about different countries and longed to go travelling extensively, while my father believed that 'nothing comes from sitting around' and encouraged the family to explore the world around us. This resulted in the family going on frequent Sunday trips to different places of special interest which were a car ride away. From this humble start my love of Geography and fieldtrips began.

I was taught Geography in England in a school which had strong Geography and geology departments and the teachers in these departments were passionate about fieldwork, which they believed was the foundation of their subject. Fieldwork trips were designed to explore, make students think, evaluate and develop a new understanding of the environment. Field work requirements were also part of the external assessments and students like myself were expected to organise our own fieldwork, from developing ideas, to gathering the data and writing up reports. This focus on the individual management of our fieldwork resulted in the Sunday family outings becoming Geography field trips. While my father sat minding my baby brother, my mother and I were in the rivers of Cheshire, England, measuring them, picking out stones and floating oranges (to determine the rivers' speed), in order for me to collect data for my Geography qualifications. Most importantly, this anchored me more firmly into the Humboldt tradition of Geography – curiosity, exploration and discovery. This approach leads naturally to my interest in, and desire to investigate, the ways in which digital technologies are contributing to my subject and influencing the way in which it is taught.

Professional perspective

Though my personal perspective is the most influential aspect in choosing the focus for this area of research, there are other aspects that also need to be taken into consideration. Having taught Geography to years 7-13 (Junior and Senior Geography) for 30 years I have seen a number of changes in the Geography curriculum. I am a passionate Geography teacher and have had to defend the subject "which is all but ignored these days" (Prensky, 2001 p.4). In addition, as a Head of Faculty working with a number of different teachers who have differing experiences in using digital technologies, I am aware of the various frustrations and concerns these teachers have. Moreover, the school where I work has a well developed whole-school policy on the implementation of digital technologies, and professional development (PD) is readily available for all staff members. The emphasis used to be that digital technologies were to be implemented in all subjects in every lesson, and while this has softened over time there are departments which still conform to this policy. To what extent are teachers being 'forced' to implement digital technologies and what are the implications for both Senior Geography teachers and students?

I am passionate about fieldwork to the extent that I try to incorporate Education Outside the Classroom (EOTC) into as many of the internal standards (school-based assessments) as the school will allow me to do. Many of my students do not have the opportunities to explore their environment as I did, and I firmly believe that in today's Geography curriculum there is more of a need to emphasise fieldwork and geographical skills. I see this as an integral part of developing curiosity, which in turn uncovers new knowledge, which will help with solving 'wicked problems' (Bolstad, 2017). Within this context, I am interested in how digital technologies can be used to promote Senior Geography in the 21st century.

Finally, the influence of my professional perspective on this study is to encourage me to achieve an understanding of the various implications of implementing digital technologies into Senior Geography. It is through such understanding that effective strategies may be developed to successfully incorporate digital technologies into Senior Geography. It is my belief that this will enhance the nature of Geography as a subject and will also meet the needs of Geography students in the 21st century.

Research Aims and Questions

Having discussed the context of my research, explained the rationale behind it and outlined the importance of my personal and professional perspectives, it is necessary to provide a structure for my study by setting out the main research aim and sub-questions which will supply the framework for my research.

The research aim

To investigate teachers' experiences and perceptions of the use of digital technologies in the teaching of Senior Geography and how these have influenced teacher pedagogies within Senior Geography.

Sub-questions

- How has Senior Geography teaching changed with the implementation of digital technologies?
- How have digital technologies changed the nature of student learning?
- In what ways are teachers and students using digital technologies in Senior Geography and what are the implications for the future of the subject?

There now follows a brief overview of the remaining chapters and their contents. The ordering and progression of these chapters indicates the structure of my research design.

Chapter Two: Literature Review – In this chapter I will conceptualise and frame the research in order to set the context for my topic. There are four major themes explored in this chapter. Firstly, constructivist and socio constructivist pedagogy; secondly, geo-technological teacher; thirdly, Geography fieldwork and technology; and, finally, teaching and learning. Dividing the literature review into these themes serves to align it with the research questions.

Chapter Three: Methodology and Methods – In this chapter I outline the methodology of the research process that I have employed in order to meet the aims of the research. Within this chapter there is justification of the research methods from a constructivist perspective. Discussion on data collection, analysis, validity and reliability are presented, as well as ethical considerations. The chapter concludes with the limitations of the research.

Chapter Four: Findings – In this chapter the findings from the interviews with the participants are presented. The responses to the eight questions asked in the interviews are presented according to common themes, in order to answer the research questions.

Chapter Five: Discussion – In this chapter there is a critical examination and interpretation of the findings based on the themes from Chapter Four and connections are made with the literature review in Chapter Two.

Chapter Six: Conclusions – In this chapter there is a conclusion which draws from the overall findings and suggests recommendations for the implementation of digital technologies in Senior Geography. There is also a discussion of the strengths and limitations of the study, which would help support further research on this topic.

Chapter Two – Literature Review

Introduction

There is a perception that, in the 21st century classroom, technology should play a major role in education, as it is the means by which the students will learn the skills needed in the 21st century workplace and will enable them to become lifelong learners. This perception has important implications for Senior Geography teaching and learning. This literature review examines the diverse opinions surrounding the implications for both student and teacher of the application of digital technologies within the Senior Geography curriculum. The four major themes examined in this literature review are: (1) Constructivist and Socio Constructivist pedagogy; (2) Geo-Technological Teacher; (3) Geography Fieldwork and Technology; (4) Teaching and Learning. In the summary, connections between these themes are drawn together to form the research questions which are the basis of this study.

Constructivist and Socio Constructivist Pedagogy

In the debate concerning the nature of education, the literature has recognised a number of complex challenges, which point to the conclusion that a creative approach is required in order to develop an education system that meets the demands of the 21st century (Robinson, 2011). This, in turn, has led to an emphasis being placed on constructivist and socio-constructivist pedagogy, and it is against this background that the implementation of digital technologies into education may be viewed.

The traditional education system that characterised the 20th century was designed to meet the economic and social expectations of an industrial society (Bull & Gilbert, 2012). Subjects, like Geography, were taught in 'silos', where teachers were the holders of knowledge and students were considered as empty vessels waiting eagerly for the knowledge to be poured into them (Freire 1970), in an approach which Freire referred to as the 'banking concept' of education. In this system, the teacher is fundamental to the learning process and the student is dependent on the teacher. The teacher speaks, the student listens and repeats. The rigid curriculum which results from this approach is designed to separate students into niches for society, based on their ability to regurgitate knowledge in order to pass external examinations.

A constructivist pedagogy sees education in a different way. Rather than assuming that students entered school with no knowledge, constructivists such as Piaget and Bruner hypothesised that students possessed knowledge that they had already learnt due to social interaction and experiences (Lawton, Saunders, & Muhs, 1980). They argued that students construct new knowledge and understanding when they experience new things and have a chance to reflect. Students sort the relevance of new experiences into their existing knowledge by asking exploratory questions, and complex knowledge and understanding develops as the student reflects. According to Chan (2002) and Lutz

and Huitt (2004), this process creates a spiral effect which allows the students to develop new knowledge. This concept is pivotal to creating new knowledge and understanding in a subject like Geography, which, it could be argued, depends on a spiral effect, where new skills and knowledge are introduced and built on each year (Woolhouse, 2016).

This link between learning and cultural and social experiences was further developed in the socio-constructivism of Vygotsky, who considered students as active learners (Adam, 2017). Vygotsky determined that, as students interact with people at an early stage of their development, they acquire knowledge in what is called the 'inter-psychological plane'. Students then supplement this knowledge by adding their own values to it, in what is called the 'intra-psychological plane'. Vygotsky insists that transferring knowledge from the social to the personal context is not copying but, rather, a transformation into new knowledge, which then becomes more complex (Adam, 2017; Hurley, Proctor & Ford, 1999). Vygotsky adds that a similar process occurs between the teacher and the student (Adam, 2017). Vygotsky also devised the 'Zone of Proximal Development' (ZPD), which looks at how the student develops educationally (Doolittle, 1995). The ZPD determines what the student currently knows and what their potential is and, with appropriate guidance, what they could achieve if allowed to socially interact through observation and participation in a given a range of activities that are both supportive and scaffolded. These activities are important as they allow the development of curiosity and critical thinking skills, which then leads to problem solving and the formulation and testing of ideas in the manner described by Bruner (Chan, 2005; Lawton, Saunders, & Muhs, 1980). In this way, new knowledge is acquired through social interactions and collaboration, and not just poured into the students (Lutz & Huitt, 2004).

This socio-constructivist approach has contributed to a paradigm shift in educational thinking (Bull & Gilbert, 2012; Wikramanayake, 2005), from the age of the machine of the 20th century, to the information and technology age of the 21st century. This paradigm shift, or way of thinking, is driven by the need to meet the needs of the 21st century and the solving of complex, otherwise known as 'wicked', problems (Bull & Gilbert, 2012). It involves looking carefully at how the education system should change and emphasis is being placed on Vygotsky's socio-constructivist ideas. The socio-constructivist approach flips the traditional view of education, which Selwyn (2014) describes as teacher led (top down), to student led (bottom up) and, as a result, exploration and innovation are seen as important practices within the classroom. Socio-constructivist teaching and learning is characterised by problem solving activities, visual aids and co-operative and collaborative group learning, where learning is done through exploration and there are authentic assessment methods. The expectation is that education is relevant to the students' needs and teacher intervention is only to promote active learning through discovery and to encourage students to explore alternatives (Hurley et al., 1999). However, there appears to be confusion amongst teachers as to what specifically a socio-constructivist classroom

looks like. Many teachers claim to teach in a socio-constructivist environment when it is more likely, due to pressures from curriculum demands, school management, parents and Board of Trustees, that they have actually adopted a mixed approach. It is in the context of this complex and changing classroom environment that the implementation of digital technologies will be investigated in this research.

Geo-Technological Teacher

Geography is a subject that has always been open to paradigm shifts, that is to shifts in ways of thinking (Neito, 2014). Geography is a dynamic subject, where new technologies have made Geographers rethink their ideas about earth processes. Geographers not only have embraced new technologies but have also been instrumental in developing new technologies, including digital technologies, to enhance the development of the subject (Kerski, 2003; Kerski, 2015). Early Geographers, like Humboldt (Wulf, 2018), saw meticulous observational note taking and the drawing of intricate maps and field sketches as the basis of Geography, especially Geography fieldwork. In addition, Humboldt also saw the importance of utilising the latest accurate instruments, though he was frustrated that, even with these, certain geographical knowledge was still unknown (Wulf, 2018). Once new technologies, like cameras and visual recordings were introduced, Geographers used them in order to perform geographical tasks quickly and with a better degree of accuracy. This approach was then transferred to the Geography classroom, where new technologies such as film strips, radio and TV programmes, overhead projectors and, more recently, interactive white boards, Google suites, GIS and the internet have been developed and teachers are actively encouraged to use them (Kerski, 2015; Wikramanayake, 2005). Tools, whether they are digital or not, allow geographical tasks to be performed easily, more effectively and with a better degree of accuracy and are vital for developing new geographical knowledge. Consequently, students are undertaking geographical tasks such as data collection, analysis and presentation in digital formats in order to create new geographical knowledge (Gladwell, 2015/2016). However, there are two perspectives with regards to digital technologies. For some teachers, they are just tools which can assist with the teaching and learning of Geography, while others see digital technologies as a catalyst for a change in pedagogy (Watson, 2001).

Just such an example of the significant impact of digital technologies on pedagogy can be seen in the use of the internet, which is considered to have 'revolutionised' Geography (Goff, 2019). Educators who support the internet claim that the goal of both the Internet and education is the same, and that is to create and exchange knowledge, (Selwyn, 2014). One of the internet's assets is accessibility, which has led to heutagogy, or self-determined learning. This is crucial in the 21st century, as education will need to prepare students to be lifelong learners and they will need to constantly upskill to meet the challenges of a changing world (Blaschke, 2012). This has significant implications

for Geography teaching, as the internet has created a variety of websites which have up-to-date primary and secondary resources, including maps, diagrams and statistical data, all of which can be shared and used to create new geographical knowledge.

The use of the internet in this way links Geography teaching with the constructivist classroom, where students can discover, model, question and evaluate information, as well as have dialogue with peers, collaborate and share information (Blaschke, 2012; Hurley et al., 1999; Sezer, 2010). There is, however, a drawback with the constructivist classroom, which does have implications for Geography, especially for Senior Geography in New Zealand, and this is the lack of prior knowledge. As Geography is only taught at a senior level and students can come into the subject at any level, those students who have a lack of prior geographical knowledge will struggle with the collaboration. Also, there is no evidence that problem solving in authentic situations will transfer to real life situations (Hurley et al., 1999).

The Geographic Information System (GIS), invented by Roger Tomlinson in 1968, is considered one of the most significant and powerful geographical tools and has been described as the digital manifestation of Geography (Dangermond, 2015). With the GIS, Geographers have access to a framework which allows data from a variety of sources to be managed, collected, analysed and presented (Green & King, 2004). This has implications for the Geography classroom as it creates an interactive learning environment where students have access to data from a variety of sources, which can then be manipulated to create maps and graphs to prove geographical theories in a variety of spatial scales. GIS allows students to see patterns, relationships and different perspectives, and allows analysis of geo-spatial scenarios (Becta, 2004; DeMars, 2016; Jo & Hong, 2018). Students who are competent with GIS are critical spatial thinkers, which means they are able to manipulate data obtained through data mining, data modelling and data analysis, in order to provide solutions to complex geographical problems (Becta, 2004; DeMars, 2016; Jo & Hong, 2018).

However, considering the educational benefits of GIS, few schools actually use the system. The system needs appropriate hardware to which schools have little access and, in addition, teachers need to be trained in using the system as well as preparing appropriate classroom resources. Moreover, students also need to be trained in the system and GIS needs regular updates with software, which leads to costs in terms of time and money (Becta, 2004; DeMars, 2016; Green & King, 2004; Jo & Hong, 2018; Kerski, 2015; Patterson, 2007). Though the literature supports GIS as a significant tool in Geography education, there is no evidence that it is beneficial in classrooms and, as a result, some schools see it as impractical and unworkable (Becta, 2004; DeMars, 2016; Kerski, 2015; Morgan & Tidmarsh, 2007; Patterson, 2007).

An alternative to GIS, which is more popular and fits the constructivist classroom is Google Earth. This is popular with Geography teachers and students as it is easier to use and is free to download. Classroom activities using Google Earth help students to think critically, as well as developing curiosity and the skill of learning by discovery.

Google Earth is relatively easy to use, with simple menus and features which allow access for all students, yet it is the first step to using the full GIS (Patterson, 2007). Teachers themselves need a small amount of training in the use of Google Earth and, as a result, there are opportunities for the teachers to create meaningful resources appropriate to the principles of Geography, namely location, environment, interaction, patterns and change. Although there is agreement that this is an important tool in teaching certain aspects of Geography, there are limitations and issues concerning its use. These include the fact that different devices, such as Google Chrome, have a different version of Google Earth, which can create problems in the classroom. Also, poor WI-FI connection in schools can hinder the performance of the system, which then leads to poor student engagement (Patterson, 2007).

Although there is abundant literature in support of using digital technologies such the internet and GIS in Geography classrooms, there are some concerns. Firstly, there is little academic support for the constructivist notion that problem solving using modelling or taught in authentic situations will be easily transferred into solving complex real life problems (Hurley et al., 1999), and there is a danger that over using computer simulations may distort the world view unless there is teacher input (Morgan & Tidmarsh, 2007). More fundamentally, however, digital technologies, such as the G.I.S and Internet sites, only provide information and, without prior geographical knowledge, humanistic understanding and a deep holistic appreciation of the issue, no new geographical knowledge is created (Morgan & Tidmarsh, 2007).

Geography Fieldwork

Fieldwork is a central aspect of Geography and has been described as being as “intrinsic to Geography as clinical practice is to medicine” (Fuller, 2006, p. 215). For Geographers, the heart of fieldwork is data collection through experiments, using skills, problem solving, reflection and observation. Although there is a drive for a greater inclusion of digital technologies in fieldwork, there are some Geographers who call for a more traditional approach. The demands on Geographers to produce more accurate maps with up to date data to explain phenomena has pushed the boundaries of technology and created systems like remote sensing and GIS. However, for Senior Geography, the fieldwork demands are not really extensive and, as such, the need for digital technologies is simpler. Digital technologies such as iPads, mobile phones, electronic clinometers, anemometers, digital cameras and the Global Positioning System (GPS) have made collecting data for Senior Geography faster, easier and more accurate (Cliffe, 2017; Gladwell, 2015/2016). In addition, apps like ArcGIS, Theodolite and Skitch allow students to make risk assessments and to annotate field sketches and photographs, which help with the development of critical thinking skills (Gladwell, 2015/2016). Digital technologies have the capacity to change the nature of fieldwork, by making it more inclusive and promoting a holistic approach to learning (Cliffe, 2017).

This change serves to link fieldwork to a constructivist approach, in which activities need to centre on problem solving, co-operative and collaborative learning, student led learning and learning through exploration, all of which are at the heart of Geography fieldwork (Hurley et al., 1999). In New Zealand's National Certificates of Educational Achievement (NCEA), Geography students, especially at Level 3, are in control of their fieldwork. Students are expected to identify their aim, plan their research, identify which instruments they are going to need to collect the data and explain why, collect and record the data, accurately present their data through maps, diagrams, graphs and tables, provide conclusions, critically analyse their findings and evaluate their fieldwork methods. There is a need for collaboration as data are collected in groups. Students are able to use digital technologies to analyse the data, which Gardiner and Unwin first did in 1986 (Cliffe, 2017). Students are also in charge of their own learning and, through fieldwork activities, they are able to construct new knowledge. This aligns with Bruner's discovery method of learning, where fieldwork is an example of a primary source (Hurley et al., 1999). Additional skills that students learn from fieldwork include being able to plan and assess risk, as well as being self-reliant and developing leadership and collaboration skills. In addition, fieldwork integrates psychomotor and cognitive skills, which holistically benefit the student (Geographical Association, 2017; Markuszewska, Tanskanen, & Subiros, 2018).

An alternative to this traditional approach to fieldwork is virtual fieldwork, which has been called a 'flagship' of e-learning (Carr, 2008, cited in Lynch, Bednarz, Boxall, Chalmers, France & Kebsy, 2008) and is one of the fastest developing areas in digital innovation (Cliffe, 2017). Virtual fieldwork is seen as capturing the real world without the issues of traditional fieldwork such as cost, weather and health and safety concerns (Cliffe, 2017; Fuller, 2006; Henry, 2004; Lynch et al., 2008). Though virtual fieldwork is not designed to replace traditional fieldwork, practitioners see them as working in conjunction. Students can 'visit' fieldwork locations on numerous occasions in order to develop fieldwork skills. This helps to provide an overview, which then assists the students to formulate ideas, develop questions and apply knowledge when they are actually on the fieldwork trip (Cliffe, 2017). Virtual fieldtrips link with Bruner's spiral curriculum concept (Chan, 2002; Lutz & Huitt, 2004; Woolhouse, 2016). By visiting similar environments online and applying geographical skills, using the same questions and modelling, complex thinking develops, which in turn leads to new knowledge being created. There are also other benefits of virtual fieldwork. Students are able to visit the fieldwork site outside the classroom environment, and this allows them to independently develop their geographical skills by repeating the activity. This builds confidence and further develops their critical thinking skills and their skills in data presentation, using satellite imagery, digital maps and graphing (Cliff, 2017; Henry, 2004). There are also benefits for teachers in using virtual fieldwork. It is easy to update each year, virtual fieldwork sites can be linked to other geographical sites for data analysis, it is portable on digital technologies, it is inclusive for all students and can be visited in all weathers. In addition, students cannot get lost or injured, which can be

a relief to school management and teachers as, unfortunately, we now live in a world that does not accept 'genuine accidents' (Henry, 2004).

Geographers who prefer a more traditional approach to fieldwork argue that learning comes from the interaction between cognitive processes and the environment (Lynch et al, 2008) and, while they acknowledge that digital technologies have helped Geography, they believe that virtual fieldwork does not compare with an actual fieldtrip (Cliffe, 2017, Green & King, 2004). The intrinsic nature of fieldwork is to get out and explore and the outside environment cannot be replicated in a classroom. No two fieldworks are the same; students each year will have different experiences as the environment is dynamic and the teacher may update and change activities. This draws on the educational ideas of Dewey and Bruner. Dewey (Hurley et al., 1999) states that learning should centre on activities that are practical and meaningful to the students' experience, while Bruner (Lawton, Saunders, & Muhs, 1980) states that students should learn concepts and ideas that they are then able to test.

Traditionalists claim that fieldwork promotes social interaction, which according to Vygotsky is significant in student learning. In addition, students on a field trip are expected to adapt to the conditions on the day, organise group work and problem solve in order to collect enough relevant data to be able to visually present the data and critically analyse what they have found (Markuszcwska et al, 2018). Moreover, fieldwork is practical, relevant and, notably, provides a feel-good factor. Research points out that these qualities have a significant impact on students providing a 'wow' factor, from either being able to put into practical use the concepts and ideas they have learnt in the class, or just simply standing at the foot of the Alps and looking up rather than seeing them on a computer (Fuller, 2006; Henry, 2004; Preston, 2016). Even though traditional and virtual fieldwork have the same pedagogy, for example they both need guidance from a teacher and are examples of discovery learning (Houghton, 2014), traditionalists claim there is no substitute for physical fieldwork (Fuller, 2006; Henry, 2004; Markuszcwska et al, 2018).

Traditionalists also point out that there are negatives with using virtual fieldwork; students can get disorientated using the system and the system is not easy for teachers to create. Teachers need technical expertise and time in order to create engaging and meaningful virtual experiences. Teachers also need to be familiar with software updates and the school system may not be able to cope with the demands of the virtual fieldwork programming. In the majority of schools there are IT technicians who are responsible for uploading the software onto the school system, but they have responsibility to the whole school and not just the Geography department (Cliffe, 2017). There is also the concern that relying on virtual fieldwork is reducing the status of the subject to 'play station Geography' (Henry, 2014) and that Geographers will essentially become 'armchair' Geographers like Carl Ritter (1779-1859), relying on secondary data and other peoples' experiences to create geographical knowledge (Holt-Jenson, 2018).

Teaching and Learning

The issues raised concerning the geo-technical teacher and Geography fieldwork have important implications for teaching and learning in Senior Geography. In New Zealand, schools are investing in digital technologies and integrating them into the curriculum as they are seen as a way of preparing the students for the dynamic workplace of the 21st century. In order to meet these needs, Geography must teach students specific skills, which will enable them to be flexible with their education and become lifelong learners (Beetham & Oliver, 2010; Benade, 2015; Blaschke, 2012). Though both the New Zealand Government and schools believe that digital technologies are a vital component of education (Network for Learning Team, n.d.), Lynch (2016) warns that schools need to be careful, as there is no evidence that digital technologies have been proven to be more effective or efficient when compared to teaching in a traditional classroom environment (Kirkman, 2017).

Indeed, there are concerns that digital technologies are being introduced into schools in a 'carte blanche' manner (Wood, Mueller, & Specht, 2005), without regard to how this will impact pedagogy (Lynch, 2016), and that the curriculum and education policies are being driven by the implementation of digital technologies rather than pedagogy (Lynch et al., 2008). All new innovations, including digital technologies, which are introduced into teaching, are met with various reactions; the extremes being that some teachers welcome them and get on board enthusiastically while others instantly reject them. There are three phases that teachers go through with new innovations such as the implementation of digital technologies. The first phase is thinking about themselves and how this will impact them; the second phase is concern over how they will implement the new innovation; and the final phase is how it will impact teaching and learning (Dwight & Garrison, 2003; Ertmer, 2005; Watson, 2001; Wood et al, 2005). The level of confidence that teachers have with regard to digital technologies will also impact the level of integration within the Geography classroom. Younger teachers (and students) have grown up with technology and are considered as 'digital natives' (Johnson, Jacovina, Russel, & Soto, 2016; Judd, 2018; Prensky, 2001), and therefore are at an advantage to those teachers who have little or no understanding and who might feel intimidated. As a result, teachers who are not confident with digital technologies are less likely to incorporate them into their lessons, as there is a perception that they will lose respect and, as a result, control of the class (Johnson et al., 2016). Any negative experiences in the classroom with regard to digital technologies will reduce teacher confidence and lead to their rejection (Ertmer, 2005). There is also a fear amongst teachers that failure to fully embrace digital technologies and integrate them into their classroom will put them in a negative light and, as a result, they will be considered as 'Luddites' or 'digital immigrants'. Consequently, teachers often feel bullied into using them (Howard & Mozejko, 2015; Prensky, 2001).

These concerns point to the conclusion that, in order for digital technologies to be fully integrated into Geography, there has to be a paradigm shift from teacher-centred to

student-centred learning, where the teacher becomes a facilitator rather than a leader. According to Johnson et al. (2016), constructivist classrooms tend to be more digital technology centred than traditional classrooms and there is a variation in usage of digital technologies depending on the belief of the teacher with regard to their appropriateness. Teachers will only use them when they see a connection with their lesson content. In addition, teachers will only integrate methods that closely align with their belief in what is good teaching practice and these beliefs come from the individual teacher's philosophy on how students learn (Ertmer, 2005; Johnson et al., 2016). Ertmer (2005), however, suggests that there is a positive correlation between teacher digital technology fluency and integration into their Geography lessons.

These issues surrounding the implementation of digital technologies into the Senior Geography curriculum are further complicated by the increasing expectations of NCEA and schools, and these put increasing demands on teachers. Teachers need to be confident with using digital technologies, including how to use GIS and Google Earth. Geography teachers need to be able to use the digital technologies in order to produce resources which engage and stimulate student interest, which in turn leads to the development of critical thinking skills. They also need time not only to learn how to use the various digital technologies but to practise and experiment with the systems until they feel confident (Dyson, 2019; Lynch et al, 2008; Page & Christian, 2009; Tilton & Harnett, 2016). Time is a barrier to implementing digital technologies within Senior Geography, as teachers not only have to learn how to use the technologies but also have to integrate them into their lesson plans in order to complement the content and meet the demands of the curriculum. This is called a 'double innovation' problem (Johnson et al., 2016), and even when teachers are more confident with using the digital technologies, the issue of time is not diminished due to this problem (Johnson et al., 2016).

In addition to the use and integration of digital technologies into teaching, the level at which they are used is also important. There are some Geography teachers who, although they believe that they are competent in using digital technologies (Wikramanayake, 2005), tend to use them in low level ways, such as word processing, PowerPoint creation and basic Internet searching. In order to meet the needs of the 21st century, however, Geography teachers should be accessing high level systems, including data analysis and software proficiency, and this requires teachers to receive professional development which costs time and money (Beetham & Oliver, 2010). In order for digital technologies to be consistently used in Senior Geography, teachers must be proficient, and this means professional development on a regular basis in order to keep Geography teachers up to date with software developments and new innovations (Johnson et al., 2016).

The implementation of digital technologies within Geography, therefore, is going to go through stages which are highly dependent on the abilities of the teacher. Integrating digital technologies into Senior Geography can be difficult, as it demands that the

course content and appropriate technology are aligned in order to be meaningful for the students (Lacrux, 2018). The ‘Substitution Augmentation Modification Redefinition Model’ (SAMR model), developed by Dr Ruben Puentedura in 2010, is considered by some as a useful tool in order to establish the level of implementation of digital technologies into Senior Geography (Lacrux, 2018; Network for Learning Team, n.d). Figure 2.1 shows the SAMR model.

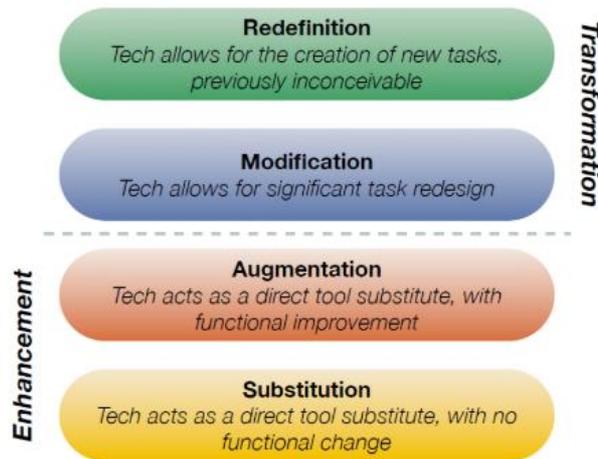


Figure 2.1: The SAMR model developed by Dr Ruben Puentedura (Lacrux, 2018).

Dr Ruben Puentedura believed that the implementation of digital technologies goes through four stages: substitution, augmentation, modification and redefinition. The model is further divided into two parts: enhancement and transformation. The basis of the model is that in the early stages, or the enhancement stage, digital technologies act as a substitute for traditional pedagogical methods. Instead of writing, the students use word processors; instead of working on the board the teacher uses PowerPoint, and textbooks are replaced with internet searching (Wikramanayake, 2005). In order for digital technologies to be fully implemented, which in the SAMR model is the ‘transformation stage’, teachers need to use digital technologies to create new tasks, which the teacher has never previously considered (Lacrux, 2018). Though the model does show how the implementation of digital technologies into the curriculum transforms the nature of pedagogy, it has been criticised as being based on Puentedura’s own experience, having only four stages and lacking other factors such as the economics of the school, the costs of teacher professional development, and student ability (Lacrux, 2018). However, the SAMR model, like all models, is just one measure that may be used to judge the reality of the implementation of digital technologies into the classroom and must be complemented by the use of other models or theories.

Whatever the level of implementation of digital technologies indicated by the SAMR model, there are several important issues which Geography teachers face that are beyond their control. Firstly, introducing digital technologies into schools is expensive.

Besides the actual equipment including laptops, there is the maintenance and the software updates which take time and cost money. Schools are limited by budget and, as a result, teachers may have to share resources such as computer suites. This means that if they have limited access to digital technologies and it is unrealistic to rely on them for lessons, then teachers may be tempted not to use them (Johnson et al., 2016). There is also the additional frustration when technical problems, including connectivity and hardware issues, mean that Geography teachers are forced to improvise a lesson. This then adds to the perception of some Geography teachers of the unreliability and unsuitability of using digital technologies (Bolsad, 2017; Johnson et al., 2016).

A second set of problems arises from the way that schools have tried to eliminate the issue of lack of devices in schools by the introduction of Bring Your Own Device (BYOD) policies. Students bring in a variety of different laptops, meaning that teachers have to be familiar with them all in order to trouble shoot any issues in the class (Morgan & Tidmarsh, 2004; Selwyn, 2014). Also, some students may bring in iPads, which are difficult to use for extended writing (Johnson et al., 2016). There is a similar issue with applications (apps). Teachers who rely on the students to download apps for classroom and fieldwork activities can have issues. If the apps are not free, the students may not be able to afford them and the devices the students bring may not be compatible with the apps (Johnson et al., 2016).

A significant issue with BYOD is the number of students with access to a device and who actually bring it to school. Students are concerned about the devices being stolen or broken (Morgan & Tidmarsh, 2004; Selwyn, 2014; Whalley France, Park, Mauchline, Powell & Welsh, 2014) and the lack of devices in the classroom complicates the lesson for the teacher. Part of the issue is that some students are unable to bring devices as they cannot afford them and, therefore, rely on the school for a consistent access to digital technologies, including laptops and WI-FI. This then creates the 'Matthew Effect' within the classroom, where the students who constantly have access to digital technologies are educationally more advantaged than those who rely on the school providing the devices (Illich, 1971). Geography teachers cannot always rely on spare computers to give to students (Morgan & Tidmarsh, 2004) or students to have constant access to digital technologies. This has implications for teaching in Senior Geography classes, including the choices of which NZQA standards to offer.

A third issue beyond the direct control of teachers is that schools often impose technologies on teachers as they become part of the school domain, without considering the individual needs of the subject areas, including Geography, or the teachers' needs. Often this is due to the cost to the school for the programmes and apps. Geography teachers have to request specific programmes, or apps, such as Google Earth, to be downloaded onto the school system and this is time consuming. Schools have to be aware that no one educational technology suits all teaching and learning (Johnson et al., 2016).

In spite of these issues surrounding the introduction of digital technologies, the literature recognises that their implementation has created a variety of opportunities for student centred learning, otherwise known as 'active learning', in the Senior Geography classroom. This includes blended learning, which is a mixture of techniques to assist student learning; flipped classroom, where the students learn at home and then practise in the classroom; and e-learning through internet suites like Google Classroom. These can motivate the students to learn at their own pace and can be beneficial for life-long learning, as they are not dependant on a teacher (Fuller, 2006; Lynch, 2016; Page & Christian, 2009; Patterson, 2007). Digital technologies, especially the internet and e-learning, allow students to study Geography in a variety of formats, including access to articles and books online, and to engage with their peers and teachers in online forums such as chatrooms, blogs and e-learning classrooms. All of this supports the belief that students should enjoy what they are doing and that digital technologies make learning 'fun' (Lynch et al., 2008; Page & Christian, 2009; Prensky, 2001; Willis 2007).

The benefits for students of this approach include the fact that learning can become more individualised and the students can learn at their own pace (Kirkman, 2017). In addition, students are expected to interact with both teachers and peers in geographical discussions online and this can break down barriers, especially for academically weaker students who may feel intimidated in voicing opinions in class. As students are considered as 'digital natives' (Judd, 2018; Johnson et al., 2016; Prensky, 2001), these forums engage students in what they are used to and, as a result, students are engaged in geographical conversations where they are using metalanguage and critical thinking skills (Lynch, 2016; Page & Christian, 2009; Patterson, 2007). Patterson (2007) adds that students using a variety of online sites show an increase in confidence with using geographical skills, content knowledge, comprehension and, more importantly, critical thinking, high order thinking and problem solving. For students, access to the internet's vast resources has meant that they are able to research and create notes much easier and a lot quicker (Lynch, 2016; Morgan & Tidmarsh, 2007; Nuttal, n.d; Olaore, 2014). In addition, it has been argued (Judd, 2018; Page & Christian, 2009) that students are more likely to get involved in discussions on social networking sites and that using digital technologies can help with cognitive learning through social activities (Olaore, 2014).

In contrast to these positive opinions on the integration of digital technologies, some writers advocate a more cautious and critical approach. One of the issues raised concerns the benefits for students of working in a traditional classroom setting where there are heterogeneous groupings of students and resources. These, it is argued, provide a variety of diverse experiences for the students involving constructive discussions and ultimately lead to the development of critical thinking and new knowledge (Oigara, 2018). In order to develop new knowledge and critical thinking skills, students must be exposed to a variety of different experiences, including collaboration and group work, but there is a danger that students, by constantly using

digital technologies and distance learning, will attempt to construct new knowledge in isolation (Hurley et al., 1999).

A second issue concerns the idea, which was mentioned earlier in this chapter, that students and younger teachers may be considered as 'digital natives'. This term coined by Prensky in 2001, means that they were born in the digital age, have been exposed to and have used digital technologies from an early age, and are therefore competent in their use. It is assumed that 'digital natives' think and act differently due to the cognitive changes brought on through the use of technology. However, Judd (2018) argues that that this term is a misconception and caution should be exercised when using it. According to Judd (2018), there is little evidence to support Prensky's notion that students today are 'digital natives' and he points out that, although they have abilities in using digital technologies especially with social media, there is a distinct difference in how the students use and see digital technologies in their academic and in their personal lives. This is backed up by Whalley et al., (2014), who comment that students appear to have low levels of digital literacy. Judd (2018) also notes that students brought up in the digital age may be able to multitask but there appears to be a negative impact on memory, learning and distractibility. Judd also argues that students' proficiencies in digital technologies are diverse but do not ultimately change the way students learn and therefore how teachers should teach (Judd, 2018).

A third area of concern relates to plagiarism. As students are increasingly using digital technologies for presenting their Geography internal assessments, there is a concern about the authenticity of their work (Loveless & Williamson, 2013). Traditional Geography classrooms tend to present geographical knowledge which students are expected to absorb. In the constructivist classroom, on the other hand, students are expected to create and generate knowledge through collaboration and experience (Chan 2002; Lutz & Huitt 2004). However, this is an issue as students with no prior knowledge in Geography will find it difficult to collaborate and will therefore struggle (Hurley, et al., 1999). This may then lead in turn to a dependence on internet search engines. A lack of prior knowledge means that students accept the first answer in the search engine without questioning it. This is an extension of the 20th century learning model, where students just accept an answer (Lynch, 2016). There may then be a temptation for them to present information from the internet as their own work.

A final area of concern about the introduction of digital technologies is that 'Google is making us stupid' (Carr, 2008). Students, it is argued, are losing the ability to concentrate due to overuse of the internet and, more worryingly, skills such as deep reading and curiosity are being lost, and students are increasingly becoming shallow in their processing of information (Carr, 2008; Judd, 2018). Due to their overuse of the internet, students are becoming 'cognitive misers' rather than the 'cognitive elite' which they need to be in order to create new knowledge (Judd, 2018). Cognitive misers do not question or push for further knowledge, they cannot see connections and patterns, and this results in minimal understanding (Leslie, 2014). This creates

problems for students studying Geography, where making connections is a vital component. Students also tend to see the need for knowledge as irrelevant and have no qualms about cheating in exams by using the internet (Lynch 2016). In this 'distributed memory' (Loveless & Williamson, 2013) the question has to be asked regarding who is doing the remembering – the student or the internet? Some would argue that the student knows which site to use to access the geographical knowledge, which they can then apply as required (Loveless & Williamson, 2013), but there is no proof that the use of digital technologies actually improves student achievement (Judd, 2018; Lynch et al., 2008; Stakkestad, & Størdal, 2017). The challenge in Senior Geography is for students to be able to critically think, problem solve and create new knowledge and the most valuable way for students to learn is by making mistakes in a safe environment, as this gives them opportunities to develop skills for coping with frustration and temporary failure (Alfi, Katz & Assor, 2004). Instant gratification smothers the development of curiosity and self-reliance which are significant learning tools in critical thinking in Senior Geography (Lynch 2016).

Summary

The literature review clearly shows that there are different attitudes and approaches towards digital technologies within teaching and learning in Senior Geography. Significant issues that need to be addressed include teacher confidence in their ability to use digital technologies, student digital fluency, and student access to devices, both within school and at home, in order to make learning using digital technologies more consistent and relevant within Senior Geography. The literature review also comments on the cost factor in both time and money for schools in implementing digital technologies and the implications of this. Focusing on constructivist and socio-constructivist pedagogy provides a productive starting point as these classroom styles align with the expectations of the 21st century expectations of education and therefore have implications on teaching Senior Geography. There does appear to be a note of caution, however, where some sources warn that educators must not let the tail (digital technology) wag the dog (Senior Geography).

The underlying theme of the literature review is that we need to examine the implications of employing digital technologies within the Senior Geography curriculum and to investigate how this impacts teaching and learning. There is a difference between what the New Zealand Government, NZQA and schools expect with the use of digital technologies in Senior Geography and the reality for Geography teachers at the 'chalk face'. Clearly the literature highlights opposing views on the value of digital technologies. On the one hand, their use is criticised as tokenism, whilst other sources emphasise how digital technologies encourage learning through the enjoyment engendered by their use. In addition, the literature also points to the possible difficulties encountered by teachers in the implementation of digital technologies in the classroom and the pressure that this places on them. On the other hand, however,

the literature also reveals the criticism which may be faced by teachers who fail to embrace the growing use of digital technologies. It follows from these conflicting viewpoints that there is a need to investigate the thoughts and feelings of actual Senior Geography classroom teachers who are faced with the task of incorporating the new technologies into their pedagogy. This need provides the motivation for my proposed avenue of research.

This literature review, therefore, lays the foundation for my research aim and sub-questions which are:

The research aim:

To investigate teachers' experiences and perceptions of the use of digital technologies in the teaching of Senior Geography and how these have influenced teacher pedagogies within Senior Geography.

Sub questions:

- How has Geography teaching changed with the implementation of digital technologies?
- How have digital technologies changed the nature of student learning?
- In what ways are teachers and students using digital technologies in Senior Geography and what are the implications for the future of the subject?

In order to answer these questions a qualitative research method will be employed to gather appropriate data. The methodology and methods will be discussed in Chapter 3.

Chapter Three - Methodology

Introduction

The literature review in Chapter 2 concluded by arguing for the need for research into the opinions and experiences of actual classroom teachers, and the issues that emerged from the literature review served to provide the focus for the research. This chapter will explain and justify the use of a qualitative research approach within a constructivist paradigm, which places emphasis on experience, reflection, values and beliefs. It will further explain how the participants were chosen and the criteria that were used for their selection. The methods used for the collection of the qualitative data and the issues surrounding the interview process will also be discussed. In addition, the thematic approach to the analysis of the data will be described and explained. After considering the important issues of validity, reliability and trustworthiness, together with ethical considerations, the chapter will conclude with an evaluation of the research method employed.

The Importance of Methodology

In any programme of research, the actual research question is of fundamental significance (Newby, 2014). The question centres the whole research and indicates which data will be needed, the methodologies required and the direction the research will take. In this context, methodology refers to how the research is to be undertaken, and it is through methodology that the guiding principles of the work are demonstrated, and the underlying questions are addressed.

In this study, the research question is concerned with the implementation of digital technologies within Senior Geography and how this has influenced teaching and learning in the subject. As a Senior Geography teacher myself (as outlined in Chapter 1), I had to adopt a reflexive approach to my research. This meant that I had to be conscious of my own bias while undertaking the research, as this could affect the whole research process, from data collection to analysis and the reporting of the findings (Dodgson, 2019). As a Geography teacher, I had to be aware that I could influence the research (prospective effect), but the research could also influence me (retrospective effect). It was essential, therefore, that continual reflection took place during the whole process in order to ensure the credibility of the research.

Research Design

This research is positioned within a constructivist paradigm. In this context, a paradigm is a set of beliefs and assumptions shared by a research community (Guba & Lincoln, 1994). This research uses a constructivist paradigm because constructivists believe that knowledge is built through experiences and reflection. This approach is appropriate for this research as it is investigating the perceptions of Senior Geography teachers concerning the implementation of digital technologies into Senior Geography and the

effects of this on teaching and learning. In the constructivist paradigm the ontology, which comes from the Greek meaning to exist or the 'knowledge of the knowable' (Dieronitou, 2014), is relativist in that it assumes that there is no absolute truth and that there are multiple interpretations of reality. My ontology for this research is that there are digital technologies in schools, both teachers and students are using them, and they are of educational benefit to students for creating new knowledge to solve 'wicked' problems (Goff, 2019; Page & Christian, 2009).

Epistemology, or the theory of knowledge, is important here in relation to the reality in schools for Senior Geography teachers when it comes to implementing digital technologies within their teaching and learning programmes. Epistemology is based on personal experiences and insight; people gain understanding from their own experiences and, as a result, will have their own perspectives on how far they should implement digital technologies and the value of digital technologies within Senior Geography. Within the constructivist paradigm, constructions of 'truth' can vary and, therefore, each participant's perceptions relate to how they see their own reality (Gubb & Lincoln, 1994). As a result, each participant's perceptions will relate to how they see and have experienced digital technologies in their Senior Geography classroom and within their own teaching and learning environment.

These experiences will also influence the value placed on digital technologies by the participants. Axiology is the study of the nature of 'value' and provides the basis of our belief about things (Hatzimoysis, 1997), which in turn impacts on how we see them. Axiology examines the values we place on items and this is unique to each individual person. People reach these values by filtering their experiences, both positive and negative, storing previous experiences and analysing them with reference to new experiences (Hatzimoysis, 1997). When teachers experience something new, like implementing digital technologies into Senior Geography, they have to reconcile it with established ideas and experiences. In the context of this research, different Senior Geography teachers will place different values on digital technologies within their subject based on their experiences. Some Senior Geography teachers will value them highly, while others will have an opposite view. This will impact on how they view digital technologies and how they implement them. It was important to understand that the participants would bring their own value-added perceptions into the interviews and that, as a researcher, I had to ensure that the participants were able to voice their perceptions as fully as possible.

Each Senior Geography teacher, therefore, will have a different perspective with regards to implementing and using digital technologies in Senior Geography and, as a result, there needs to be 'interpretation' to discover the underlying themes. The most appropriate method for data collection here was qualitative research, which is concerned with how people feel about particular situations and make sense of the world as they see it (Newby, 2014). It aims to achieve an understanding, through case study evidence, of what people believe about a particular reality, in this case the implementation of digital technologies within Senior Geography.

Research Sample

As this is a small-scale piece of research, it was important that the choice of the participants was relevant to the research aim and questions. In order to gain a broad picture of teachers' perceptions there also needed to be a range of teaching experience and decile of schools. In order to gain the widest possible range of participants, important criteria were applied to the selection process. It was important that the teachers included in the study were from a wide range of schools within Auckland and had at least two years' experience in teaching Senior Geography within NCEA. They should, therefore, have had opportunities to use digital technologies in order to fully implement the curriculum. It was also important that a range of decile schools were represented in the research, as this might identify important differences.

The process of recruitment for the participants was via adverts placed in the Senior Geography Teachers NZ Facebook page as well as through the Auckland Geography Teachers Association (AGTA), (see Appendix B). Though there was interest in participating, the respondents from the Senior Geography Teachers NZ Facebook page were outside the Auckland area. In order to narrow the response to Auckland, emails were sent out to various principals and Senior Geography teacher clusters. The emails that were sent out to schools included the Participant Information Sheet (see Appendix C) and the Consent Form (see Appendix D). Initially, four responded and then a further two were contacted through word of mouth. Participants were then emailed and sent digital copies of the Participant Information Sheet, the Consent Form, a sheet containing the interview questions and an explanation of what the term 'digital technologies' was referring to (see Appendix E). I felt that it was important that participants had time to reflect on what they would be asked, as this might result in clearer and more detailed answers. It also helped to make the interview process with a stranger less intimidating and made it more likely that the participants would open up and freely express their perceptions. Giving them a definition of 'digital technologies' also prompted them to discuss the broad range of digital technologies that they use. I felt that the slow uptake at the beginning was a combination of the time of year for the interviews and teachers' initial concern at being questioned on their ability with digital technologies in Senior Geography.

The most significant element was the experience of the teachers. This was important as beginning teachers have just started to develop their understanding of the Senior Geography curriculum and are developing their pedagogies. More established teachers, however, have a foundation which can enable them to develop and try new innovative approaches. Also, a range of Geography teaching experience might help to uncover a wider range of viewpoints. The participants' range of experience in this research was from 3 to 15 years.

The decile¹ of the schools to be involved in the research was also important. The decile of a school signifies the socio-economic nature of its location and is therefore a

¹ In New Zealand, schools are rated from 1-10, with 1 being the lowest and 10 being the highest. Schools rated between 1-4 are further subdivided into three bands, low, medium and high. The decile system is designed to award government funding to help those schools who have a higher proportion of students from low socio-economic communities. This means that a school with a decile rating of 1A has

measure of the home environment of the students. This is relevant as it may indicate a student's ability to access digital technologies to use in their studies and, consequently, their proficiency in using them. This will include, for example, the ownership of laptops and access to WI-FI connectivity. Although decile ratings are for government funding, the perception of many parents and people outside the education system is that they give an indication of school performance, discipline and quality of education and, consequently, the facilities in the school to provide quality 21st century education. For this research, it was important to have a variation in the decile of schools involved, in order to get an overall picture of the implementation of digital technologies in Senior Geography. Students from low socio-economic communities are believed to be dependent on schools and teachers for their knowledge building as they are less likely to be exposed to experiences such as holidays and trips to the museum and theatres (Illich, 1971). This leads to the 'Matthew Effect' (Scardamalia & Bereiter, 2003), between those students who are exposed to various experiences and those who are not.

Table 3.1 shows information about the participants, including the deciles of their schools. Each participant was from a different school. There were three from decile one, including one from each of the subdivisions. These three schools were located in South Auckland and were from similar cultural as well as socio-economic communities. This was important as New Zealand has put a lot of funding into schools with WI-FI and access to computers, in order to decrease the gap between the 'haves and the have nots' (Scardamalia & Bereiter, 2003). The other participating schools were located close to South Auckland and were of higher deciles. It was important to get a broad picture even within a small scale research study such as this.

Table 3.1. The participants: school decile, years of teaching and gender.

Participant	School decile	Years of teaching	Gender
1	1	3	Female
2	1	14	Male
3	6	9	Female
4	10	9	Female
5	5	3	Female
6	1	14	Male

Data Collection Methods

As this is a small scale research project the most suitable approach to gather Senior Geography teacher's perceptions was through individual semi structured interviews with flexible open ended questions. It was important that the participant felt comfortable to express their feelings and not be intimidated by other participants' experiences and, as a result, the interviews were conducted individually. In the interviews, the use of semi structured questions allowed for the in-depth study of the participants' experience of using digital technologies in Senior Geography. The

a large percentage of students from the low socio economic communities, while decile 10 has the lowest.

participants were able to freely articulate what was important to them through description, narration and reflection on their experiences. It is important that they were able to do so with authenticity, as it conveyed their reality and their understanding of the world as they see it (Brinkmann, 2008). As the researcher, I was then able to use probes to clarify interesting points or inconsistencies (Barriball & While, 1994). This approach helped to reveal themes and patterns and to identify problems with the implementation of digital technologies in Senior Geography.

However, there are some limitations to this technique. Firstly, probing questions which seek clarification may not be asked in the same depth to all participants as, in a sense, it is the participants who are guiding the interview. In addition, it was important to realise that participants may be looking for clues from the researcher to indicate the validity of their answers. Indeed, the participant may attempt to read the body language of the researcher, looking for subtle indications that their contributions are valid (Partington, 2001) and that they are not letting the interviewer down with inappropriate responses. One final problem is that individual interviews can result in awkward silences, where the interviewee runs out of things to say and the ensuing panic leads to an uneasy atmosphere.

In the organisation of the interviews, steps were taken in order to try to address these limitations. Firstly, the participants were given a list of the questions and the definition of digital technologies in the interview (see Appendix E). This was to provide a stimulus to help them remember how digital technologies are used in their Senior Geography classes. In groups, people may be reminded about what they have done through the process of the discussion acting as a prompt. With this research, however, this approach would not have been appropriate due to the possible diverse range of abilities with digital technologies among the participants and the imbalance in access to digital technologies across the schools. This could have created an uneasy atmosphere and embarrassment for the participants, which would have hindered an honest response. By realising that there were weaknesses, therefore, it was possible to anticipate issues and bring in strategies to help minimise them, remembering throughout that the whole purpose of the interviews was to obtain as much accurate data as possible in order to see patterns and themes (Hammarberg, Kirkman & de Lacy 2015; Partington, 2001). In order to further ensure the validity of the data, the interviews were recorded on two devices and then transcribed by approved transcribers. The participants then received copies of their transcripts to check for accuracy.

Data Analysis

The analysis of the data followed the thematic approach suggested by Braun and Clark (2006), who argue that this method can provide a rich, detailed and complex interpretation of data. In their method, the process of thematic analysis begins when the researcher identifies patterns of meaning and issues of potential interest in the transcribed data. This involves the coding of interesting features and the collation of codes into themes.

The thematic approach is often compared to interpretative phenomenological analysis (IPA) in that both are dynamic approaches, where the researcher attempts to develop an insider's perspective of the participant's world view (Smith, Flowers & Larkin, 2009), in this case the implementation of digital technologies in Senior Geography. In both approaches, the participants' experiences and feelings are significant and are expressed in their own words through interviews (Braun & Clarke, 2006). The significant difference between the two approaches is that IPA is 'theoretically bounded' whereas the thematic approach is not (Braun & Clarke, 2006). This is important as this research is not attempting to prove a theory but to develop an understanding of reality in relation to the implementation of digital technologies for Senior Geography teachers.

The thematic approach is doubly hermeneutic, in that the researcher is asking the participant to convey their interpretation of what is happening in relation to a topic and then the researcher is attempting to interpret the participant's perceptions of their reality (Braun & Clarke, 2006). In order for the thematic approach to work, the researcher has to go through six processes which are outlined by Braun & Clarke (2006). These are shown in table 3.2.

Table 3.2 Phases of thematic analysis (Braun & Clarke, 2006. p. 87)

Phase	Description	Description of the process
1	Familiarising yourself with the data.	Transcribing data (if necessary), reading and re-reading the data, noting down initial ideas.
2	Generating initial codes.	Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code.
3	Searching for themes.	Collating codes into potential themes, gathering all data relevant to each potential theme.
4	Reviewing themes.	Checking if the themes work in relation to the coded extracts) and the entire data set, generating a thematic 'map' of the analysis.
5	Defining and naming Themes.	Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme.
6	Producing the report.	The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis.

These six stages of thematic analysis are designed in such a way that the transcripts of interviews may be examined by the researcher in order to arrive at a 'story' (Braun & Clarke, 2006) which makes sense of the participants' views. As the researcher progresses through the phases, they become more familiar with the data and are able to divide them into individual themes from which a final report can be written.

An essential part of this process is known as coding (Braun & Clarke, 2006). Coding is a way of analysing qualitative data in order to identify themes and patterns (Westbrook, 1994). The heuristic approach is to first read the interviews in order to identify themes. There will be themes the researcher may expect to see but this first reading may uncover different themes, which may become significant or may be discarded. After this initial coding, where the researcher will obtain an overall idea of themes and the perceptions of the participants, the next stage is line by line coding. This is where the researcher scrutinises the interviews line by line in order to reveal more themes, perceptions and implications. Again, some of these themes may be later discarded, as it is imperative that the researcher is guided by the research question. The final part of

the coding processes will be to sort the themes into groups. Many of the codes will be interlinked and could be interpreted in different ways but this will always be subjective (Christians & Cory, 1989). This approach enabled me to see themes, patterns and anomalies in the ways that teachers are implementing digital technologies in Senior Geography and provided a structure for the presentation of findings in Chapter 4.

Validity and Reliability

In any research, the issues of validity and reliability may be called into question. Validity concerns the accuracy of the research, while reliability is about the replicability of the data if the research process were to be conducted again. For some researchers, qualitative research and thematic analysis can be considered as 'airy fairy' or not real research (Braun & Clarke, 2006, p. 95). However, the nature of this research method allows flexibility and permits the researcher to discover a wider range of perspectives that have not been narrowed down by theories or presumed assumptions (Braun & Clarke, 2006). There is always an assumption that any research method is not 100 per cent perfect and that errors in data collection and bias will affect the results. Ultimately, however, the aim of the researcher is to maximise the validity and reliability of the research to the best of their abilities.

To ensure integrity and consistency in my research, all the participants were sent a list of the questions and the 'definition of digital technologies' sheet in the initial email and were given these again at the start of the interview. The participants were free to think about the questions before the interview in order for them to be fully aware of what was expected. Additional questions were only asked to clarify points.

All the interviews were conducted individually. At the start of each interview, I introduced myself and explained the research and the rationale behind it. Participants were also informed that the interviews would be recorded and transcribed, and that they would receive a copy of the transcript to check and amend if necessary. Confidentiality was promised to the participants and their schools, and they were told who would have access to the recorded interviews. All this was completed before the consent forms were signed.

There is a perception with research that the results will be consistent and therefore dependable and that this then proves the reliability of the research (Hammarberg, et al., 2015). However, in a small scale research project such as this, it is important to appreciate that the data obtained may not be indicative of all Geography teachers in different schools across New Zealand. Clearly, the views of six people cannot be assumed to be the views of all Geography teachers, and if the same research were done in other New Zealand schools there could well be different results. However, whilst bearing in mind this issue of replicability in qualitative research, it was important for me to believe that this does not invalidate my findings. The important point here was for me to understand that the interviews provided a 'snapshot' of the perceptions held by six teachers and to not make generalisations based on a limited number of participants, some of whom may have unique perspectives when compared to other teachers.

Trustworthiness, Credibility and Transferability

Although this is a small scale research project, it is important nevertheless that it has undergone the same robust procedures as any other programme of research (Hammarberg et al., 2015), for it is through such rigour that the process may be seen to be trustworthy. Transparency is important here, which means that any reviewer is able to follow the various stages of the research development, from research design, data collection methods and analysis, including justification of the methods chosen, through to the ethics protocols (Hammarberg et al., 2015). Therefore, it was imperative that, as the researcher, I was consistent in all aspects of the research process.

With semi structured interviews, however, consistency can be difficult, as the participants are free to discuss their perceptions, and this could lead to concerns about the trustworthiness of the findings. Participants will have varying degrees of real life experiences with regard to implementing digital technologies in Senior Geography and, as a result, the perceptions will vary. As the participants were able to speak freely, it was possible for them to go off at a tangent, but by giving them the questions before the interview they were less likely to do this. In addition, the probing questions could also be used to bring the conversation back to the agenda. By recording these probing questions in a journal, I had the opportunity to reflect on the interviews, and this was an effective way for me to clarify the themes and patterns that emerged (Bastian & Holsblat, 2017). Therefore, a careful, consistent and rigorous research process was necessary to make the findings trustworthy.

Trustworthiness in qualitative research also involves credibility and transferability. Credibility, the extent to which the findings can be trusted and believed in, is important in qualitative research as it is one of the criteria by which the research may be evaluated (Hammarberg et al., 2015). To achieve credibility it was important that the conclusions were recognisable to other Senior Geographers who are implementing digital technologies in Senior Geography. In order to achieve this it was vital for me as the researcher to practise reflexivity (Hammarberg et al., 2015). This requires the researcher to reflect on how the research is affecting them and influencing their bias. In order to combat these effects it was important to ensure that I exerted little influence in the interviews beyond asking the main and probing questions.

It was also important that the findings faithfully reflected the participants' perceptions of implementing digital technologies in Senior Geography. Even though these perceptions may not be applicable to all Geography teachers, excerpts from the findings may resonate with them. It was important, therefore, that the findings gave a substantial description, complete with verbatim quotations from the transcripts (Hammarberg et al., 2015). Perceptions that are recognisable and resonate with other teachers, therefore, serve to give credibility to the findings. Such perceptions also support the concept of transferability in qualitative research. If other Senior Geography teachers recognise enough similarities with their own perceptions and experiences, they will surmise that the findings could be applicable to their own or another situation.

Ethical Considerations

As part of the research process, ethical approval had to be sought from AUTEK and the substantial document required for this provided a detailed outline of the whole research process. The ethical considerations included informed consent and the protection of the participants' confidentiality.

Informed consent

Each participant was sent a Consent Form, a Participation Information Sheet, a list of questions and a definition of 'digital technologies' via email. Both in the email and at the start of the interviews participants were assured of confidentiality. The participants were also informed that they would be sent copies of their transcripts, which they could read and amend if desired, and they were also informed that they could withdraw from the research up to a week after the interview. The participants were thanked before and after the interview and were assured that there would be no follow up communication, with the exception of sending them the transcripts. They were further informed that they would have access to a summary of the completed dissertation in due course.

Confidentiality

In any research confidentiality is an important consideration. All the interviews were individual and, as a result, the identities of the participants were known only to myself and my research supervisor. The names of the participants and the schools were never referred to in the transcripts. As the interviews were individual, the participants were able to receive a copy of their transcript in order to check for accuracy. This research depended on voluntary participation, which required the participants to be able to speak freely about their perceptions. This could only be achieved with total confidentiality for both the participants and their schools.

Confidentiality was further ensured by referring to the participants by pseudonyms in this dissertation§ and not mentioning the names of the schools. These details were known only to me and my research supervisor. The original consent forms, transcripts and audio are stored at AUT in accordance with the AUTEK requirements.

Limitations of the Research – Methodology and Design

In every programme of research, there will always be limitations that must be taken into consideration when examining the findings. There are two significant limitations arising from my methodology and research design, and it is important to highlight these before presenting the findings.

The first limitation is the size of the sample. By using only a small sample, conclusions cannot be generalised as they only represent a small percentage of the total number of Senior Geography teachers in New Zealand. In addition, the participants selected may have unique circumstances in their schools and have perceptions that are not necessarily comparable across all schools. This research, therefore, should be regarded as a snapshot of these participants and their experiences at this time. A wider sample would, of course, generate more perceptions and experiences, which would then lead

to a more in-depth understanding of the implications of implementing digital technologies in Senior Geography. A larger sample size would also include more variety in schools' decile ratings, which would provide greater information on the accessibility of a range of different digital technologies for Senior Geography teachers and students and their experience in using them. With any research, of course, the more evidence the researcher has then the more accurate their conclusions.

The second limitation concerns the timing of the interviews. The interviews were timetabled at the beginning of the academic year, which is a busy time for Senior Geography teachers. This, I believe, was one of the reasons initially for the small uptake of participants to the research. Senior Geography teachers were asked to either use their non-contact time or to make themselves available after school. These times are precious to teachers for preparation or extra-curricular activities. Given the opportunity to do this research again, I would make certain that the timing was different in order to ensure that the teachers had more time to reflect on the questions beforehand, did not feel rushed in the interviews and did not regard their participation as an unwelcome addition to their workload.

Summary

This chapter has outlined the methodological approach to this research. It has explained and justified this qualitative research method within a constructivist paradigm. It has explained the methods of selecting the participants, and the collection and analysis of data. In addition, it has discussed the issues of validity, reliability and trustworthiness, and has outlined the ethical considerations. Finally, attention has been drawn to some of the limitations of the research methodology. The findings of the research will be presented in the next chapter.

Chapter Four - Findings

Introduction

This chapter presents the findings from the interviews in order to address the main aim of the research and the sub-questions.

The research aim:

To investigate teachers' experiences and perceptions of the use of digital technologies in the teaching of Senior Geography and how these have influenced teacher pedagogies within Senior Geography.

Sub questions:

- *How has Senior Geography teaching changed with the implementation of digital technologies?*
- *How have digital technologies changed the nature of student learning?*
- *In what ways are teachers and students using digital technologies in Senior Geography and what are the implications for the future of the subject?*

In order to answer these questions the participants were asked the following eight questions in the interviews:

1. How long have you been teaching Senior Geography?
2. Does your school have a Bring Your Own Device (BYOD) policy?
3. How are digital technologies being implemented within Senior Geography?
4. What are your experiences of using digital technologies within the Senior Geography curriculum?
5. In what ways have digital technologies influenced or changed your pedagogy?
6. What is your perception of student engagement and learning when using digital technologies in Senior Geography?
7. How has the implementation of digital technologies in the Senior Geography curriculum affected you?
8. How do you see teaching Geography with digital technologies in the future?

This chapter presents the answers from the participants in themes which relate to the dissertation questions.

Question One: How long have you been teaching Senior Geography?

This question was asked to ascertain their length of time teaching Senior Geography, which is important as it confirmed their eligibility to take part in the study, as explained in Chapter 3.

Table 4.1 shows the participants' length of service teaching Senior Geography. It was important that participants had some experience of teaching Senior Geography as this would mean they were familiar with the curriculum and would have more confidence in adapting new elements, such as digital technologies, within their teaching and

learning programmes, as well as having had the opportunity to use digital technologies in Senior Geography.

Table 4.1. Participants' length of service teaching Senior Geography.

Participant	Number of Years
One	3
Two	14
Three	9
Four	9
Five	3
Six	14

Question Two: Does your school have a Bring Your Own Device (BYOD) policy?

Though there were variations in the answers, the common pattern was that five out of the six schools represented did have a BYOD policy in some form, while one school had no BYOD policy at all.

The participants discussed the BYOD policy in their schools, and this clearly revealed a variation in how the policy is implemented. Only two of the schools had full implementation while others had none, or it was relaxed. Two of the participants appeared to be unsure of the extent of the implementation; Participant Five stated that "It should be implemented by now", while Participant One stated that "I think it starts with Year 11".

The participants also commented on the student uptake of bringing their own devices to school. In two schools there was an expectation that the students bring the devices from Year 9, with one of these schools expecting the students to buy the computer from the school, fully preloaded with the school's individual intranet webpage and associated school programmes. Five participants commented that the uptake by students was varied. The main reasons given were the fear that the devices could be broken or stolen, financial issues for the families, variations in use within lessons and student preference. Even though it is school policy, in the senior school the uptake was left to student preference and teachers accepted and adapted to student choices. Participant Three stated that: "For Geography we use it when we can and then students use their devices and computers as notes if they want to, or a book, so it's kind of a flexible agreement"; while Participant One stated: "Not all of them would come with their own device".

Participants also spoke about the issues that arose when the students did not bring their devices to school. Two schools mentioned the issue with finance for the students, as their families may not be able to afford devices and then the student would have to rely on the devices provided by the school. One school spoke about an agreement that departments had with the Library:

Especially students of families that obviously cannot afford it. We have an agreement with the library, so there are spare devices we can loan out to them for the day. But then you have the issues of sometimes the library runs out and they have wasted time going to the library to get one. Sometimes they forget to return the device back to the library at the end of the day ... so then it is a ban for them, they can't get a device out so then it's a negative effect on education (Participant Three).

In addition, students who had no device or had forgotten to bring it to school, would have to use the ones in the department. All the schools referred to the fact they did not have access to class sets on a regular basis and the ones they had access to have to be booked in advance.

Behind us there are 15 Chromebooks there that each student gets when they come into the class. One of the problems is I've got 15 of them and my classes are all bigger than 15. But we do have a technology suite as well, but again, the problem with the technology suite is booking it (Participant Two).

Most departments will have Chromebooks which you can book, but they are split amongst whatever classes are there. It's kind of like a first in first served... I am lucky because I am in a computer room...but if my room gets booked, which it can...the whole department has access to my room...the students are pushed away into other rooms, into wherever that is, so it can cause an unsettling at the start of the lesson (Participant Five).

We are sharing digital technology, we are sharing laptops. We have three Senior [Geography] classes but we also have history classes and classics classes...so it is really hard to schedule a time when Geography would basically have a set of laptops (Participant Six).

There were also problems with the state of the departmental devices which also create issues: "We have about 25 and often they are missing keys or you need an extra keyboard or something"(Participant Five). Also the number of devices departments have can diminish over time due to the devices breaking or going missing: "We bought 30 five years ago; we're down to like nine, eventually they kind of disappear" (Participant Three).

Participants also spoke about the expectations from their Senior Leadership Teams (SLT) with regards to BYOD. There were two extremes; one was an expectation that students would be using their own devices in all classes, including Senior Geography, while the other extreme was that, even if there was a BYOD policy, it was largely ignored in favour of extended writing practices to prepare Senior Geography students for NCEA external examinations. Participants, however, spoke of school expectations that a BYOD policy should be fully implemented: "Yes. It is expected now. It went through every year so it should be fully integrated now. Every student should have their own devices and teachers are supposed to integrate lessons to fit that in as well" (Participant Five).

While at the other extreme:

So the policy- we do have one but...I would say we don't use it as often as we should...Basically it comes down to senior leadership and what they want to push. We've basically been pushing writing...Getting the kids to write for 30 minutes or longer so that they are prepared for the external exams (Participant Six).

Though some of the schools have a BYOD policy, Participant Four admitted: "To be honest, we don't do as much BYOD as probably people think we do".

Question Three: How are digital technologies being implemented within Senior Geography?

This question was designed to discover the types of hardware (devices) and software (programmes used on the devices) the participants use in their Senior Geography programme. Table 4.2 shows the digital technologies implemented by the participants into Senior Geography grouped into categories.

Table 4.2: Digital technologies implemented into Senior Geography in categories.

Category	Total
Hardware	13
Applications (APPS)	8
Video platforms	6
Online platforms	4
Games	3
Word Processing	3
Social Media	2
Virtual reality	1

From Table 4.2 it can be seen that the most common category is hardware, which consists of the devices that teachers and students use. Hardware includes laptops, smartphones, scanners and projectors. The most common of these are laptops, which the students have access to via BYOD or by using the ones provided by the school. The digital tools most used by the participants need internet access, from the online platforms such as Google Suite to virtual reality. The most common use of the internet was for research and though there were concerns about students getting distracted while on the internet, which will be discussed later, the overall consensus from the participants towards using the internet was positive.

Online platforms and laptops

Four of the participants stated that within the school there is an online platform which they are expected to use. Online platforms incorporate a variety of different apps which allow video meetings, chat functions, word processing, links to the internet, social media and educational functions like feedback and marking student assignments. Participant Four described her school's unique online platform:

IT uploads the school's own private desktop...it has their own internet websites, their own webpages, their own OLE page...Everything is there. It is very insular...You are not going to find the same programme at any other school.

While Participant Five stated: "We all use Google APPS, so Google Classroom, Google Docs and Google Slides. Everything is really integrated through Google, so they are able to be really collaborative". Participant One stated how they were currently using Teams: "[This term] I've started using Teams because we don't use Google Docs. That's why I am trialling it at the moment".

Participants also commented on how students were using laptops in conjunction with the online platforms or word processing sites to produce their work. The two most common uses of laptops were for writing up assessments and researching on the internet. Participants also commented that other work could be uploaded, and students could work collaboratively on a single document. Participants, therefore, were positive about using the laptops and online platforms especially for student assessments:

Students can just type it into there and then submit it through there so you can give them feedback (Participant One).

Checking assessments as well, I can comment straight onto the assessment...They don't have to send it to me because when I put the assessment up I automatically have access to everything they are doing (Participant Five).

One participant spoke about the advantage of laptops and online platforms of the work always being accessible, especially for the students:

For the most part, students do work better in the senior school in terms of typing their assessments. You don't have that, oh, I left it at home as much or, oh, I was sick, or I couldn't upload it online (Participant Four).

You can store all the resources there for the students, as opposed to giving them worksheets that they will probably throw away afterwards (Participant One).

In speaking about accessibility, Participant Three added that because students have constant access to the resources it allowed them to catch up.

Smart phones

Smart phones were also implemented but in different ways. Four participants spoke of how they use smart phones on fieldwork but only two referred to using actual apps and this was with varying success:

We go on fieldtrips, we go to the dairy farm so there's nothing much there apart from photos and when we go to Rotorua again it is mainly just photos and interviews (Participant Two).

We do things like downloading apps for fieldwork equipment. For example we are going on a fieldtrip...and they are to measure the angle of the beach. So I tried to get them to download this app Dioptre which is great on Android; doesn't exist on Apple (Participant Four).

Participant Two also spoke about different ways of collecting fieldwork data while using a smart phone:

I do a bit of work on the smart phones with the weather forecast one. We don't have a weather station, but I use the phones to take the information from the phone app and compare it to the met service.

One participant spoke about using Google Cardboard on smart phones for virtual fieldwork where they use a cardboard container to hold the phone and use the app on the phone to see different places.

Scanners and projectors

All the participants use projectors in order to present their PowerPoints and other visual material. One participant mentioned using scanners and this was for moderation. The participant scans either part or all the students work and then sends it to NZQA.

Other apps and programmes

Other apps and programmes mentioned by the participants, which are used within Senior Geography, were videos, social media, games, quizzes and face time. The use of digital video platforms like YouTube, Netflix and eTV was also described. Generally they were mentioned in passing as examples of teaching aids. However, Participant Three made this point: "Visuals like YouTube and eTV, movies whatever, it's good to put it in perspective for the students especially places they haven't been".

Social media was specifically mentioned twice, once in relation to gathering resources from Facebook (Participant Five) and once by Participant Four in relation to students using it to collect fieldwork data.

Games and quizzes from Kahoot! or Google Forms were also used as mini tests to see what the students had learnt. These were mentioned in passing as tools teachers used. Participant Two had heard of them but had not used them, while Participant Five had used Google Forms to check student progress.

Question Four: What are your experiences of using digital technologies within the Senior Geography curriculum?

The responses to this question were shorter than the others due to the overlapping nature of the questions. The question was designed to narrow down the teachers' own experiences in their classrooms, and from the responses two major themes were identified: issues with hardware and the level of skill of the students.

Issues with hardware

Hardware refers to the various digital devices used in the Senior Geography classroom – including laptops, smartphones and connectivity. All participants spoke about issues with either students not having any devices and/or the poor connectivity, which had a negative impact in Senior Geography classes:

But then there are always problems... Like it takes too long to load and those kind of issues when we are using digital technologies, so it is not always efficient because there will be problems with laptops, or the Wi-Fi is down (Participant Two).

Participant Four described with exasperation one experience when there were connectivity issues:

There were three days where we had no Wi-Fi for the whole day...No-one could do anything because the push has been to put it all on devices and then you get to class and there's no Wi-Fi... You cannot count on using Google for researching and doing that part of it.

Participant Four then added: "I guess the thing is that the school has pushed for an inquiry process... which is great in theory, but in practice when you do not have Wi-Fi it doesn't work".

Participants also spoke about the lack of devices and the differences in devices, which were also issues in the class. The lack of devices for students and the different devices the students and participants were using was an issue. For example, Participant Two spoke about the students being on Chromebook while they were on Microsoft:

I don't have a Chromebook. I'm on Excel and Microsoft. What I use is different from what the students use...like for doing even a simple bar graph, the way I do it on my sheet is different from theirs... so I have to do it on a Chromebook but I don't have it... if you are not on the same system...it gets a bit complicated.

Participant Two also commented on the experience they have when trying to use smartphones in an out of classroom experience during a Senior Geography lesson: "The minute you go outside you will find they don't have a phone or it's their mate's phone or they don't have credit on it". While Participant Six commented on the clash between school policies, the lack of devices and the need for the students to complete the Geography work: "We tried to ban phones in class...[but] teachers could say... if you can't use a laptop then use your phone, if you have enough data".

Students' ability

The differences in the ability range of the students was also discussed by the participants. There were disparities in students' abilities and their interest in digital technologies and this was discussed at different times during the interviews. In response to this question the participants noted that the students could not use the devices for educational purposes as well as they could for social media but that the perception of school children is that they are digitally literate:

Not all the kids are really into it, but they are on devices, but they are not into understanding how to use the devices for work. They use the devices for distraction. It's teaching them that a device is a tool for learning, not just a TikTok dance (Participant Two).

Participant Four also reflected on student abilities:

I guess it's using Apps they're familiar with because we talk about students as being digital natives but they still do not know how to send an email...how to print...When I say open a Word document or create a Google Doc there are still issues around saving...they save it under the date rather than the name of the topic. You're talking about the students being digital natives, they're actually not. They are digital natives in social media and in crazy Apps like TikTok... But that is not educational. When you're talking about educational digital media they need to be taught.

Participant Four continued by explaining the students were "savvy" at getting around proxies to download illegal movies but could not organise their work or insert a table into a Word document.

Participant Six spoke about two students who had come to their school from a school where they had used digital technologies on a more regular basis and in a variety of ways and they described how they appeared to be more digitally literate:

We noticed that these kids were real tech savvy because of the schools they had come from, and we just asked "what did your previous school do?" [They said] "Oh everything is done online, everything is digital". They were able to help other kids who weren't digital savvy in trying to work their way around a computer.

Question Five: In what ways have digital technologies influenced or changed your pedagogy?

This question was designed to find out how the participants had changed their teaching styles through the implementation of digital technologies, to see if they had moved from a traditional to a 21st century style of teaching. The participants' responses can be grouped into three themes: interaction with students, the use of digital technologies by the participants, and barriers to implementing digital technologies through pedagogy.

Interaction with students

All six participants spoke about how they used digital technologies in order for the students to complete assessments and most assessments were completed digitally, though Participant Four did state that it was student choice and those that wanted to handwrite it still could. There were slight variations in the digital platforms used by the students to complete the assessments. Five participants mentioned how they put all the resources onto a school network drive, such as Google Suite, in order for the students to have instant access and for them to “catch up and complete work” (Participant Three).

Participant Five compared their previous school to their present school with regards to putting course information on the school digital platform: “It’s just the school I was at before, they weren’t Google integrated. [Google] makes it more accessible...[it] makes everything I teach more accessible to them. So it’s breaking down the barrier in my teaching”.

Participant Three also discussed the accessibility of assessments and the benefits of being able to edit them online especially for the On-going Resource Scheme (ORS) students:

Some students will definitely work better with devices, so people with like ORS funded kids or kids with dyslexia seem to find it better. I think it helps with the structure of their assessment. They often like to edit, obviously on their devices when they are using Google Doc, so they find that good for assessments, so it kind of strengthens their learning.

Another form of interaction with the students is through feedback with their assessments. Five participants spoke about the benefits of using digital technologies in terms of the ease of instant feedback, for the students to get this feedback to improve their work and the ability to track students’ progress through checkpoints:

I think it is an easy way to track student progress because you can see what they have typed up and you can also give them feedback, as opposed to getting their work in class and having to write out the feedback. You can access it at any time, and they get the feedback faster (Participant One).

We do checkpoints. I check their assessment twice and give them feedback in between the assessment... every task has different feedback. Having the feedback straight on the document, even just a comment is really good (Participant Five).

Participant Five also commented on how they use quizzes and Google Forms to complete formative assessment to track student progress and to assess the outcome of the lesson. An important feature of teaching is the interaction between teacher and student in the lesson. Participant Two spoke about how digital technologies are changing this aspect of their teaching:

It’s changed my teaching...I am more of a presenter of information rather than the teller of information. I often use the phrase now, “Listen, I don’t

know what you guys can find out from me”, I give them more open questions. I say “There are 20 of you here, if you find some information, it will be 20 times more powerful than the ability for me to find the information”.

While Participant Five spoke about the “breaking down of the barriers in their teaching”, Participants Three and Four spoke about digital technologies making their teaching more flexible. While positives were identified in the interaction between teacher and student, some issues also arose. Participant Four spoke of the increased use of emails and the issue with the school policy that these emails have to be answered within 24 hours, including at weekends: “I guess that’s also the other downfall...because students have your email, school policy is you answer all emails in 24 hours... Parents email at weird times. They email at 11.00pm and expect a reply”.

Additional issues raised included the monitoring of the students while they are using the devices and how this had resulted in a change to their pedagogy:

In other ways you have to be strict with them and also have to monitor, which can take time as well. Stand at the back of the classroom instead and be more on them with that as well. It has changed quite a lot (Participant Three).

You have to watch them the whole time because the second your back is turned they are back playing the game (Participant Four).

We have tried to stop kids using their own phones or their own devices and basically just use the devices we give them so we can try and monitor any sort of behaviour in terms of them actually doing the work and them looking up social media (Participant Six).

Participant Four also spoke about the changes in lesson planning and explained how they feel that the lesson now has to be better prepared and more structured:

It has to be structured, you have to have a starting point and a finishing point and be like “there has to be an end product which has to be like a table which has to be typed up and printed into your book and I will be checking the end product”, if there is no end product it is a free for all.

The use of digital technologies by the participants

A consistency in the interviews was that all participants used some aspects of digital technologies in their teaching, such as projectors, PowerPoints, quizzes, and visual aids such as YouTube, in addition to the word processors. Participant Five stated that “I use a projector to do most of my lessons on. The kids come in and the work will be on the board. That’s probably as much as I use it”, but also added that “maybe I’m more reliant on PowerPoints than I was”. Participant Six said that “most of the time I use PowerPoint or show videos on YouTube”.

Barriers to implementing digital technologies through pedagogy.

The interviews indicated that there were different levels of digital literacy amongst the participants though they all agreed that they needed, and would like, additional training in order to implement digital technologies within the Senior Geography programme. Three themes were identified which were considered as barriers to implementing digital technologies in Senior Geography. These were upskilling for general digital technologies, using GIS within Senior Geography and accessing professional development.

Upskilling for general digital technologies

The six participants reflected on their skill level in using digital technologies and were honest about their abilities:

I think in terms of if I was to say there was a con to how it has affected me, it would be, I don't know everything about technology. That's why we don't implement everything that relates to digital technologies in Geography (Participant One).

Participant Two felt that "There is one thing I really would like to do, and I need to do, [and that] is to improve my digital awareness and knowledge and stuff like that", while an interesting point made by Participant Three was that there were so many aspects of digital technology that would be implemented into the lessons that you tend to learn one piece of technology then another and forget how to use the previous technology: "We have used Google Cardboard in the past for virtual reality. We didn't use it a lot. We've tested it, but we often forget how to use it".

Using GIS within Senior Geography

Within the Senior Geography curriculum there is a GIS internal standard, where students are expected to use GIS to solve a geographical issue, colloquially known as the point 8's (1.8, 2.8 and 3.8).² Only two of the participants' schools did the GIS standard but only at Year 11 (1.8). There was a common theme with the four schools that did not do the standard and this centred around the lack of knowledge and confidence:

But not necessary to do stuff like Google Earth and that. I am not really familiar... But I do use Google Maps (Participant One).

This year a goal I've set to do the 1.8... but I'd like to do more of it...If I had someone to show me how to do this rather than trying to find a way of doing it myself. I'd like to do more of it (Participant Two).

We don't do any GIS at this school and I would really like to, but I have no idea (Participant Five).

² In the Geography Assessments there are three standards, one at each level (1-3) which requires the students to use digital technologies to solve a geographical problem. These standards are AS91014 (1.8), AS91247 (2.8) and AS91433 (3.8) and they are colloquially known as the point 8's.

We have never done it. We tried to push it, but even when we got back from our technology guys they said it would be too much to implement at the time, so basically we haven't done it (Participant Six).

Accessing professional development

All six participants spoke about the accessibility of professional development (PD) and how they required PD in order to implement digital technologies within the Senior Geography programme. Five of the participants stated that going on PD was not an issue but there was an expectation that they had to organise it themselves. Participant One believed that "if I did find something on professional development for Geography and gave it to them (SLT), they would be OK. But it would be up to me to go and look for the PD". Participant Three explained that "If you find a course you want to go on, generally they sign you off and say you can go, and so there is that opportunity".

Participant Four spoke about the issue of accessing PD in their school:

I started a year ago... and on the first day of my induction, I got told I would be given PD on the school's internet system... but I am still waiting... a lot of it has been asking peers or actually sitting down and figuring it for yourself.

Even with access to PD there were two participants who commented on the need for further PD:

I had one PD last year and it was at the end of the year... and it sort of piqued my interest and I'm trying to do a little more (Participant Two).

I would really like to get GIS integrated. We actually had a couple of PDs but are not confident enough to integrate that in (Participant Five).

In organising and going on PD the issue of time was brought up by one participant:

We don't have the time to go out and look for PDs and to ask around if there is a PD for this. I think with everything we do already as teachers there's not that much time to go out and ask for PD (Participant One).

Question Six: What is your perception of student engagement and learning when using digital technologies?

The two main themes which emerged from the interviews in answer to this question were student engagement and student learning. These can be broken down into sub-themes.

Student engagement

The reflections from the participants on student engagement while using digital technologies in Senior Geography were sub-divided into two sections – higher engagement and lower engagement.

Higher student engagement

Participants noted that there was higher student engagement when the students were taking part in activities centred on GIS and Google Earth, quizzes, Kahoot!, and other

visual apps such as YouTube: “The only time I find that they actually do learn is when we use GIS and Google Earth. I think it is the most valuable aspect of digital technologies” (Participant Four).

When using videos in Senior Geography Participant Five reflected:

[There is] a higher engagement [of students], for example, if we are working off a video. I think they are more engaged in the video, depending on what it is, than they are listening to me working off a PowerPoint.

Three of the participants spoke about how the students enjoyed doing the quizzes and using Kahoot! Participant Two commented that “Kids love quizzes”.

Lower student engagement

The main reason for lower student engagement during lessons when using digital technologies was distraction. All the participants had had experiences of students not working on their schoolwork and getting distracted with online games and YouTube. Participant Six believed that the level of distraction was due to the ability of the student.

A lot of them are distracted by what they can go on like YouTube, playing sort of games, where the other half are not. I think it comes back to streaming the kids at junior. So the top stream are pushing for credits and are engaged in their learning.

Participant Five would appear to back up this idea that students pushing for credits would be less distracted: “They’re working towards credits, they are motivated. They choose to be there”.

The consensus of the participants was that games and YouTube were the main forms of distraction. Participant Four estimated that at least 5 out of 20 students would be on games rather than doing their Geography work, while other participants referred to students answering their emails or doing other work as additional forms of distraction. Interestingly, Participant Two believes that tapping into this addiction especially for boys may be an advantage for teaching GIS (1.8):

That’s why I want to do 1.8 this year because especially with boys, where computer games are...they are obsessed with them so it’s okay, they have got those skills, let’s see if we can get some credits with their digital skills, trying to show them different things to do rather than just sitting on Fortnite (online game) for two weeks (Participant Two).

On the other hand, Participant Six expressed a reluctance to use digital technologies due to the distractions: “I am really wary about giving them the use of the technology because of what they can do in terms of not doing the work”.

Learning

Three sub themes came out of the participants’ responses with regard to learning: research and assessment, plagiarism and basic skills.

Research and assessment

Participants spoke about students using digital technologies for research and assessments in Senior Geography classes. Students carry out research, type up their work and either upload or email their assessments to their teachers. Participant Five reflected: "I think their assessments are better when they are digital, which could be contested. But, yeah, I think the quality of the assessments are better because they have more access to resources".

Students have more access to different Apps which means they can take a more active role in how they present their assessments: "Finding new ways to do assessments or a new way of doing...like writing up projects or anything like that, which is good" (Participant Three).

Though the participants spoke about using digital technologies in Senior Geography for research there was some concern as to whether the students know how to research properly: "I refer them to webpages...give them specific instructions to do on the webpage rather than [tell them to] go to that webpage and have a look around" (Participant Two). The same participant also brought up an interesting point that teachers are still in control of students' learning: "So you are limited in some aspects of the webpages you can use, but you are more in control".

Plagiarism

The participants voiced a concern about students plagiarising their work, as many of the assessments had a research element within them, which involved looking for information on the internet in various ways, including webpages and videos. Participant One spoke about the ease with which students can 'cut and paste' and the ease of Level 3 students finding information from various sites and piecing it together in their work: "[Students] know the tricks of getting information from here and there, so they discretely try and put it into their own work".

Participants spoke about the challenges of ensuring that the students' work was original and of monitoring their work: "Making sure everything is in their own words is a challenge" (Participant Five).

Interestingly none of the participants' schools use Turnitin to check for plagiarism, though Participant Four referred to a plagiarism checker that is on their system:

We have our own plagiarism checker that goes through OLE, (the participant's school's individual online platform), you upload your assessment and it comes back with similarities. It works pretty much like your normal Turnitin, but it's the school's own one that they developed.

The other participants either had not heard of Turnitin or spoke about it being too expensive for the schools to purchase. The main way the participants checked for plagiarism was to type in 'suspect' sentences into Google and see what came up.

Basic skills

The drive to obtain credits in Senior Geography was discussed and, for the participants, this focus on credits and digital technologies was changing the nature of learning in

Senior Geography. Participant Two spoke in depth about their frustrations on how the students now appear to have “a lack of wonder” and a lack of general geographical knowledge: “My Year 11s were just doing a basic map of Auckland. ‘What’s the two harbours in Auckland?’ The most common question was ‘What’s a harbour?’ This shocked me”.

The lack of curiosity and motivation to find out more also frustrated Participant Two:

They don’t have the curiosity to find out more about where they live and the planet and with global warming, which they all seem to know about, but they don’t know where they live. Information is always there but there’s no need to retain it. It’s not put as “Why should I retain this?” But just a general lack of wonder and interest and curiosity in other parts of New Zealand, Auckland and the world, is probably my perception of it. And they are driven by credits. Is this in the credit count? Why do we need to know that? That’s frustrating.

The participants also commented on the poor basic skills shown by the students and attributed this to possibly using digital technologies:

I do feel like a lot of digital technologies are affecting their literacy, capital letters, full stops...spell check is not really teaching them how to do it by hand...Unfortunately, their literacy is getting worse, whether that is because of BYOD or not, I don’t know (Participant Three).

Participant Four related an incident that happened in their recent Senior Geography class where the students had to add up numbers to create an appropriate scale. The students could not add 1.1 to 7.9 and were astonished when the participant could do it without a calculator. Many were doing similar basic maths using a calculator: “It’s simple maths that they are struggling with now. Same with literacy”.

Participant Four added:

I think they are struggling. In terms of numeracy for sure. They don’t know how to construct a bar graph on paper. They don’t even know what a scale is. You are literally going back to teaching the basics from Year 7...

It goes back to the whole digital native for social media verses educational. They don’t know how to do the formulas, they don’t know how to input the formulas that’s the problem.

Participant Four concluded:

So BYOD, yes, it’s given many opportunities to research and do more with but it’s also, I think, actually limited a lot of their learning ability at the same time... We assume that they’re digital natives and they don’t need that information, when really they do. I think there’s going to be a huge gap coming up in the workforce.

Question Seven: How has the implementation of digital technologies in the Senior Geography curriculum affected you?

Two themes emerged from this question based on teacher ability and teacher engagement.

Teacher ability

All the participants noted that, regardless of their individual ability using digital technologies, they had to upskill in order to increase the potential of using digital technologies within Senior Geography: "I had to upskill definitely, even some of the basis I don't know... That's sort of the negative side I guess, the time trying to find things and having a play around" (Participant Three).

Participant Three also pointed out that there is an issue with time, which other participants also commented on. This involves time to upskill, either through PD or just individual upskilling, especially if they were to introduce the GIS standard. Participant Two stated that a goal was to introduce 1.8 (GIS) at the start of the school year but, realistically, this would be a challenge with all the other expectations in term one. As a result, if it were to be introduced it would be more likely to be later in the year and they suggested the department would: "Just dip our toe in the water and see how it goes".

Participant Two also added, with regard to their ability concerning the Geographical skills paper:

I would like to do it more digitally and I don't know if I could, so I put it into the too hard basket. But I think the kids might quite enjoy it, but I wasn't confident in myself... I have lots of paper resources, but I don't want to go down the paper route. I want to go down the digital route.

The participants agreed that the implementation of digital technologies for them was a 'slow process' or a 'work in progress' due to their digital literacy.

Teacher engagement

The agreed consensus was that implementing digital technologies within Senior Geography had positives, though at varying levels. Participant Three spoke about being more creative in lessons and having to think about what works for the students, while Participant Four spoke about lessons having to be more structured with a finished 'product' at the end of each lesson.

Participant One spoke about the students having access to the resources in one place, which for them was positive as both the teacher and student could access the resources anytime and not just in class. Participant Five backed up Participant One by using PowerPoints which they saved to the school platform in order to ensure that the students were getting the necessary course content.

It's affected me positively because I know that all the content is getting to them. I'm not missing anything, especially when I am learning it myself or taking on a new context or a new assessment that I haven't done before. I

was very reliant on it, but that was a positive thing because I could use the PowerPoints for help.

Other participants commented on the ease of marking assessment, students uploading assessments and the reduction in excuses from students about bringing in their work. Participant Six also referred to challenges they had encountered within the lessons when using digital technologies. They spoke of the frustration of not having enough devices for students as well as constraints from Senior Management with regard to providing more digital devices for the students, which they saw as a barrier for Senior Geography. Participant Six noted how the department had frequently asked for new additional devices but had been denied, which they felt impacted on the way they could fully implement digital technologies within the Senior Geography programme: “We can’t make our units digital. It’s really hard in that aspect”.

While there was an expectation by Senior management for the implementation of digital technologies within Senior Geography, a repeated concern was the lack of digital skills shown by the students which affected the Senior Geography lessons. The participants spoke about teaching students how to use the technology before they could teach actual Geography: “You’re finding, actually, you are spending two weeks teaching them the basics of things like ‘cut and paste’, saving and control alt whatever. They don’t know the basic stuff” (Participant Four). Participant Two stated that the main problem is “just getting everyone in the classroom at the same starting point”.

Participant Four believes that there is an assumption that we overestimate the abilities of the students with regards to digital technologies, which is not taken into account when designing units for the Senior Geography programme.

Question Eight: How do you see teaching Senior Geography with digital technologies in the future?

This question was to see how the participants foresaw the implementation of digital technologies within the Senior Geography curriculum, with regard to both teaching and learning and also external assessment requirements, and these were the two themes that emerged from the interviews.

Senior Geography teaching and learning

Within this theme there were variations in the responses regarding the significance of digital technologies within Senior Geography. Participant Two stated:

I think we have a massive advantage because we have the technologies that bring the world alive...People carry it in their pockets and it’s just connecting this to this and how you use Geography with the technologies because people actually do use it every day with Google Maps.

Student resources

With regard to student resources being online, Participant Five spoke about increasing the amount of resources and introducing Google Doc textbooks which would replace

traditional textbooks and become a one-stop resource for the students. They explained how the students would have the information and worksheets and would put their answers directly onto the document.

Fieldwork

Participant Five spoke about virtual and actual fieldwork. They would like to use more virtual fieldwork, especially when actual fieldwork is difficult to carry out. Participant Five would also like to use more digital technologies in actual fieldwork. They would like to use iPads for data collection and analysis:

We are trying to... get access to iPads so we can use those, especially for surveying because we do paper surveys at the moment and it takes a long time to input... So we are trying to see if we can get access to iPads or devices because then we can put it straight into Google Forms; it would collate the data and put it automatically into graphs.

Participant Two also spoke about attempting to use more digital technologies in fieldwork but saw this as a future project as currently there is concern in crossing into other disciplines within the school: "We'd like to go outside and do some water measurements...I think as Geographers we are well placed to do that, but that comes down to our Science Department who are fairly protective of their freedom".

Caution and barriers

Although there was enthusiasm, Participant One was cautious and showed concern about teaching the students various geographical skills and not relying solely on digital technologies: "I see Geography as a hands on subject where students are not limited to just using digital technologies...digital technologies are a shortcut for them".

Participants also spoke about how barriers could stop the implementation of digital technologies in future Geography teaching. The participants spoke about the students not being on 'the same level', both with computer skills and availability of devices: "But it's getting everyone in the classroom at the same starting point...That's the barrier I see at the moment" (Participant Two). This participant continued by saying that "it would be great if everyone could just come in and switch on and then they can actually design their own lesson and present their own things", while Participant Four stated that "[It] won't be effective until everyone is equal".

Participant Six feared that the disparities in accessing and using devices was creating disadvantages for the students: "Technology is moving fast; the kids are at a disadvantage because they won't be able to keep up with what other schools are doing and what their peers are doing".

Participant Six continued by discussing both digital and non-digital skills such as reading and writing in the future:

I'm really sceptical about moving too fast, the kids need basic skills first... I don't know if there is a medium between how fast digital technologies are moving but also the basic skills of the kids themselves. There are certain things the kids should learn first.

Participant Three reflected:

I'm very much in the middle. Depending on the students you have, depending on their maturity, their motivation, their organisation it can definitely be positive. But then for other students who aren't as focused or maybe organised, I think it is a negative.

Expectations of NZQA

The participants spoke about how they currently used digital technologies for NCEA internal assessments and moderation. Participant Five spoke positively about the digital moderation process and how they overcome the issue of students' work on paper, especially mapping: "If it is mapping I often just scan them, and I can send them off for digital moderation...I scan them straight into the assessment".

There was not such a positive consensus when the participants spoke about external examinations. Participants spoke about their concerns for the future of geographical skills if examinations are to be done on digital devices, as they agreed that geographical skills should be done by hand. Participant Four expressed the concern that, if NZQA wants all externals to be completed digitally, then geographical skills would be removed from the curriculum:

If you say, well okay, if its online we are not going to ask them to draw anything, are you actually accessing a skill? Because if you are no longer accessing a skill you're assessing their reading comprehension. That's not what Geography is. Geography is not just read a resource and answer a question. Geography is where you pull out the information, you need to redraw this... It is not hit a button and everything works. So I can't see it working.

Participant One, when speaking about external Geography NCEA examinations, commented:

In terms of exams for Geography I wouldn't necessarily recommend digital technologies or getting them to do their exams through a digital process. I see Geography as a hands-on kind of subject where students are not just limited to using digital technology... The skills paper in Geography requires students to draw things or measure out physically for themselves, but with digital technology it is a shortcut and it's not them actually doing the work... I think Geography should be left as it is, writing and getting them to actually physically draw or measure things...and also to draw diagrams.

Summary

This chapter has presented and described the results from the data collected. It has outlined how the participants have implemented digital technologies into their Senior Geography classes, together with their perceptions of using them. The various perceptions were summarised to show the implications of using digital technologies in

Senior Geography, both for the teachers themselves and for the future of the subject. The following chapter will analyse these results in relation to the existing literature.

Chapter Five – Discussion

Introduction

This chapter will critically examine the findings from the research data in relation to the literature review in order to address the central aims of the study. The chapter begins with a recap of the research questions and a summary of the key findings. The results are then discussed according to the aims of the study, in particular through the three sub-questions, and with reference to the literature review. The chapter concludes with a summary of its main themes and a link to the concluding chapter.

Recap

The main aim of this research was to investigate teachers' experiences and perceptions of the use of digital technologies in the teaching of Senior Geography and how these have influenced teacher pedagogies within Senior Geography.

This main aim was then addressed by means of three sub-questions in order to focus the research:

1. How has Senior Geography teaching changed with the implementation of digital technologies?
2. How have digital technologies changed the nature of student learning?
3. In what ways are teachers and students using digital technologies in Senior Geography and what are the implications for the future of the subject?

Summary of Findings

This section provides a summary of the main findings from Chapter Four.

Changes to Senior Geography teaching

The findings regarding the changes to Senior Geography teaching with the implementation of digital technologies highlighted three main areas. Firstly, the interaction between students and teachers within Senior Geography; secondly, teacher ability and student engagement; and thirdly, the barriers to implementing digital technologies within Senior Geography.

With regard to *the interaction between students and teachers*, the findings showed that, although the traditional 20th century teaching style was used, this interaction had been made easier by the implementation of digital technologies. There was evidence of a slight paradigm shift towards a socio-constructivist classroom but this was in the early stages. The participants are still holders of the knowledge and, through the use of digital technologies, students have constant access to this knowledge. The participants facilitate this access by either uploading material to online platforms or using email. This material is then used by the students to complete their NCEA internal standards or to gain access to the Geography content needed for their NCEA external standards. This is an important finding, as students being dependant on the teacher for knowledge is not the expectation in the 21st century classroom.

Participants reported having to be more creative in their lesson planning but a counter to this was the need to be stricter in their classroom management, to ensure that the students were on task and not distracted. The participants commented on incorporating digital technologies into their lessons but there was a concession that there had been little change from the traditional teaching style. There appears to be an increase in collaboration between teacher and student, especially in terms of feedback and feedforward on assessments, which was seen as a positive aspect. One negative in the findings was the expectation that the teachers were 'on call' 24/7. Students depended on the teacher rather than taking charge of their own teaching and learning.

In regard to *teacher ability and student engagement*, the consensus from the participants was the need and desire to upskill in order to implement digital technologies within their Senior Geography classes. While access to PD was not restricted, the findings show that there is an expectation from the senior management teams that the participants find their own PD and the participants are not sure what appropriate PD is available. The findings show there were varied confidence levels when using specific Geography software, like GIS and Google Earth, and, as a result, the uptake in the 'point eights' was varied. The findings make it clear that there is no uptake in GIS, while there was limited up take in using Google Earth. PD in these software tools was also limited, though the participants did show an interest in learning how to use Google Earth.

The findings suggest the main *barriers to implementing digital technologies* into Senior Geography in order to have a change in pedagogy are the level of digital literacy of the students, and the availability of the digital technologies, in particular laptops and connectivity to Wi-Fi. The combination of these factors results in there being disparities in the implementation of digital technologies across the participants' schools. The findings indicate that issues with the BYOD policies, connectivity to Wi-Fi and the variations in the devices students bring to school ,or the participants have access to, combine to create a dysfunctional situation in Senior Geography classes and, as a result, the implementation of digital technologies is sometimes seen by the participants as 'too hard'.

Changes to the nature of student learning

Digital technologies have been regarded as a means of getting the students engaged in their learning and ultimately taking charge of their learning. The findings show that students tended to be engaged when they were participating in activities that were regarded as 'fun', such as quizzes or visual activities like watching videos from YouTube. The participants also noted, however, that the students were also distracted by social media and gaming sites. The findings indicated that levels of student engagement depended on the aim of the lesson and it appears that there was a rise in student engagement when they were working towards credits. Concerns were raised in the levels of student literacy, numeracy and basic geographical knowledge as well as the desire to learn, which the participants also saw as issues for student engagement. Other issues in regard to students using digital technologies within Senior Geography classes, were the increase in plagiarism, poor internet research skills and issues with

NZQA regarding Special Assessment Conditions (SAC), but the overwhelming issue was the inconsistency of student access to digital technologies within Senior Geography.

How digital technologies are being used in Senior Geography and the implications for the future of the subject

For all the participants, the implementation of digital technologies into Senior Geography in accordance with the SAMR model (LaCruz, 2018), was through enhancement. This means that participants generally were substituting traditional pedagogy with digital technologies. The majority of the participants used online platforms like Google Suite provided by their schools. The most popular hardware applications were laptops, smart phones and computer projectors, while for software they were word processing, YouTube and PowerPoints.

Concerning the future of Geography as a subject with the implementation of digital technologies, the findings exposed a conflict between the expectations of NZQA and the NCEA Geography standards and the implementation of digital technologies. The conflict centres on the appropriateness of the way in which digital technologies are being implemented into Senior Geography and the implications surrounding the very nature of Geography with regard to geographical skills. In addition, concerns were raised regarding the expectations of the participants from SLT about students gaining credits and the students meeting the required standards imposed by NZQA.

The findings in this study also show that actual Geography fieldwork is still a significant part of Senior Geography and virtual fieldwork is seen by some of the participants as a backup or an extension. Small steps were being taken towards implementing digital technologies into Geography fieldwork through substituting traditional methods of collecting and recording fieldwork data with digital technologies such as iPads and smart phones.

Discussion of Findings

The findings from the interviews will now be discussed in relation to the literature review and in accordance with the three research sub-questions.

1. How has Senior Geography teaching changed with the implementation of digital technologies?

This section will discuss the findings from interview questions 4, 5 and 7. In the interviews the participants were allowed to talk freely and, as a result, there was a tendency for answers to overlap. Nevertheless, three main areas were identified, as indicated in the summary of findings above, and these will be discussed in greater detail here.

Interaction between teacher and student

This study shows that there is still a dependency on the traditional format of classroom teaching within Senior Geography, in that the classes are still teacher led. The expectation of both school and student is for the teacher to provide the information and for the student to complete the assigned work. Even when students are tasked to

do the research on the internet, the tasks are still structured and directed rather than allowing the students to take charge of their own learning, which is the expectation for 21st century learning (Blaschke, 2012; Hurley et al., 1999; Sezer, 2010). This expectation, discussed in Chapter Two, is that digital technologies would be a catalyst for a change in pedagogy (Watson, 2001) and, in conjunction with the constructivist approach, would lead to a shift in the dynamics of the classroom. The idealised hope shown in the literature review is that lessons would be student led, while the teacher acts as a facilitator (Johnson et al., 2016; Selwyn, 2014) and this, apart from one small reference from a participant, appears not to have been realised yet. From the findings in this research it would appear that one of the changes in pedagogy is that the teachers are actually in more control of the lesson as they not only provide the resources, but also give more structure to their lessons in order to achieve a consistent outcome. In addition, the teachers are expected to monitor the students to ensure they are on task. One concerning reference from a participant is that they stand at the back of the classroom more to ensure that the students are on task; this is not 21st century learning or learning in the constructivist classroom.

The changes in teaching that the participants in this research referred to was to do with presentation in their lessons. Participants described the various online platforms, such as Google Docs, as well as the other apps like YouTube and Kahoot! The reality, therefore, is that the participants have only substituted aspects of digital technologies into their lessons but have kept the traditional approach. This concern was also raised in the literature review by Wikramanayake (2005) and in more detail by Lacrux (2018), when describing the SAMR model and its implications. Though some of the participants felt that they were fully implementing digital technologies into Senior Geography they were only describing how they have substituted one form of teaching and learning for another. There was an expectation that the students would type up their essays and then either email them to the teachers or upload them to the online platforms instead of handwriting them. Even within the two schools who had a relaxed BYOD policy there was still the expectation that the students would follow this procedure. Whether the participants fully understand what it means to implement digital technologies within Senior Geography is unclear. The SAMR model is clear that, at the lowest level, digital technologies are used to replace traditional learning activities but the outcome is still the same, instead of writing you type. To fully implement digital technologies means that the students are asked to complete activities that can only be done using digital technologies and the tasks the students are to perform were previously inconceivable (Lacrux, 2018). The idea is that students are being stretched in both their knowledge and understanding of geographical topics and are expressing their new understanding in a variety of different ways which can only be created through the use of digital technologies. From these research findings it appears that the participants are a long way from achieving this goal. What is evident is that the perception of the participants is that the use of low level digital technology should be considered as actually implementing digital technologies and, as a result, represents a change in their pedagogy.

Though some participants did speak about collaboration between student and teacher, especially when working on Google Docs, or how the use of digital technologies had made them more creative to meet the needs of the students, the overriding image from the participants was that the chalk board or white board has been replaced by PowerPoints and for some participants these are 'safety nets' to ensure that the Geography content is delivered to the students. One significant form of collaboration that the participants spoke about was being able to make comments on students' work and the ease with which students have access to their work. The participants felt that this was beneficial for the students and a definite advantage of implementing digital technologies within Senior Geography. The literature review also commented on how digital technologies help to engage students with their teachers. The results from this research did expose a problem for teachers with regard to access, as one participant spoke about how their students and parents have teachers' email addresses, which has had the result that teachers are emailed at any time and there is an expectation that teachers respond within 24 hours. This has implications on teacher workload and wellbeing, as it would appear that teachers are now expected to be 'on call' 24/7. This is unrealistic and is not the expectation of 21st century education, in which students are expected to manage their own learning and the teacher should be the facilitator guiding the students not be the students' 'buoyancy aid'. The students should not feel the need to constantly ask the teacher for information and expect to be 'spoon fed' with knowledge.

In the literature review, it was indicated that the instant access to resources and student work allows the participants to see how the students are progressing and, while the students have access to the resources, it means they are able to continue with the work at any time and at their own pace (Kirkman, 2017). Students, therefore, are not dependent on the teacher and can learn from a variety of digital media such as online books, chatrooms, blogs and e-learning classrooms (Fuller, 2006; Lynch, 2016; Page & Christian, 2009; Patterson, 2007). Most of the participants in this research commented on how easier it was for them to upload the material and this had become part of their pedagogy. They feel confident that this allows the students to have access to the course content they need in order to pass NCEA assessments. However, there has to be a word of caution, as students will engage with those subjects that they have an interest in and avoid doing the work that they find difficult or have little interest in. There is also the possibility that, without supervision, students using chat rooms or social media may be off task or open to a more dangerous situation.

There was a consensus from the participants in this research that they wanted to try out new approaches in implementing digital technologies within Senior Geography, including introducing more GIS through Google Earth and attempting to do the 'point eights'. This is encouraging, as it is through these small steps that teachers' confidence will grow and there will start to be a gradual move away from the substitution of traditional teaching and learning in Senior Geography towards redefining the activities and learning outcomes.

Teacher ability and engagement

A strong finding in this research, which was consistently repeated throughout the interviews, was the importance of teacher ability in using digital technologies and the need to upskill. The literature review also discussed the needs of teachers to have time to learn how to use the digital technologies in order for them to become confident and therefore fully implement them into Senior Geography (Dyson, 2019; Lynch et al., 2008; Page and Christian, 2009; Tilton & Harnett, 2016). Clearly, it is the issue of time that seems to be the major barrier for the participants in this research. This is not an unrealistic concern as the participants have various other tasks as part of their profession and there is an expectation that any new techniques they wish to learn and to practise, including digital technologies, should be completed in their own time. In order for extensive implementation of digital technologies to take place within Senior Geography, priority has to be given for PD and, more significantly, time made available to the participants. This, of course, has significant cost implications for schools but, if the participants are determined to implement digital technologies into Senior Geography, then PD is the way forward.

Confidence levels in using GIS systems, including Google Earth, are low according to the participants in this research and, as a result, they tended to avoid introducing the GIS paper in Senior Geography (known as the 'points eights'). The most significant issue is that they felt unable to use GIS or Google Earth to produce the necessary visuals to meet the criteria in the NCEA standard. This NCEA standard requires the students to manipulate data to create a series of maps to solve a geographical issue. This is a challenge for most of the participants in this research and, as a result, they do not have the confidence to teach their students how to tackle the tasks. In addition, the students also do not have the skills to complete this assessment and, consequently, it is easier for the participants not to put this into their Senior Geography curriculum.

The literature review indicates the importance of students having an understanding of using GIS and, just like the results from this research, there appears to be an avoidance of implementing GIS within Geography. In this research there are no schools which have implemented it, though two schools have implemented the 'point eights' using Google Earth and there is one school which would like to try to implement it. The participants also mentioned other issues with the implementation of the point eights, which included the lack of devices, variation in devices and the issues with connectivity to Wi-Fi. The connectivity issue is a major problem for introducing GIS into Senior Geography as if the connectivity is not consistent then the programmes will not work and this creates further issues for the teacher. Google Earth is an easier option but does still rely on Wi-Fi. The major issue with using Google Earth is that the features are not consistent across different devices, and participants who have tried to use Google Earth soon became aware of these differences.

The issues described by the participants were also noted in the literature review in the reference to Patterson (2007), who also noted that these issues could impact student engagement. For the majority of the participants it is 'easier' just to avoid doing the 'point eights' and, as a result, the participants are not allowing their students access to what is described in the literature review as the manifestation of Geography

(Dangermond, 2015) and is considered an important skill needed to provide solutions to complex geographical problems. Indeed, problem solving is a significant part of 21st century education and, even if the participants only introduce the students to Google Earth through doing the 'point eights', it is a start. The concern should be that teachers who avoid this geographical technology could experience problems in the future, for if, as is likely, the curriculum changes and there is an emphasis on implementing high level digital technologies, teachers and students will be left behind. It is therefore vital that the participants in this research become more confident with using Google Earth and begin to incorporate it within their Senior Geography teaching.

The literature review commented on the digital literacy of people in the 21st century. The assumption was that the 'younger' generation would be more digitally literate than the 'older generation' as they have grown up with accessing digital technologies, while the older generation had to play catch up (Judd, 2018). Though the literature review refers to students, relatively young teachers would logically be grouped into the category of 'digital natives' (Judd, 2018). The expectation would therefore be that those participants who are relatively new to teaching Senior Geography would have come from universities and teachers' colleges with higher abilities in using digital technologies and would be able to implement them in order to enhance Geography as a subject. The findings in this research, however, show that no matter the teaching experience of the participants, they encounter the same issues and possess the same ability levels and a similar level of confidence when it comes to the implementation of digital technologies into Senior Geography. It would seem, therefore, that teachers' ages and experience do not have as great an impact on their use of digital technologies as might be supposed (Judd, 2018).

Barriers to implementing digital technologies into Senior Geography

Though the need to upskill was a considerable barrier for the participants, there were other barriers that hindered the change in pedagogy. One of these barriers discussed by the participants was student ability, and this was a recurring theme in the research findings. As already mentioned, the literature review discussed the perception that some people regard current students as being born of the digital age and therefore are 'digital natives' (Judd, 2018), while teachers are 'digital immigrants', who are playing catch up with their fluency in digital technologies. The literature review warns against this assumption and, indeed, the findings in this research match with this view. Participants discussed how they have to spend time in their lessons showing the students how to use the digital technologies, in particular with low level tasks. Participants commented on how the students were unable to save their work, or create and insert tables and graphs into their work, and even had difficulty remembering their passwords. This lack of ability in using digital technologies by the students means that the participants, even if they had the ability to perform the high level tasks like using GIS or three dimensional modelling on the computer, would be restricted in their teaching.

The students may have been brought up in the digital age and the participants may agree with the literature review that their skills are low level but this has to be taken in context. Participants are expecting the students to use digital technologies in an

educational setting and some students may not see the connection. The students are 'digital natives' when it comes to the latest social media and apps. They are savvy about getting around the school proxy systems in order to log on to social media, which the school IT technicians are constantly having to block. The participants, however, are expecting the students to use the digital technology in the same way that the participants use it, without utilising the skills the students have. One participant in this research spoke about 'giving in' to the students' request to use Snapchat on the Geography fieldwork trip and only allowed it if the students ensured that they were actually collecting the data. This then raises the point that if the apps the students are using can perform the same job as the apps the teachers recommend, surely this is an opportunity for the students to take the lead in their own education and is a small move towards realising the vision Selwyn (2014) describes in the literature review, a socio-constructivist pedagogy where the student leads and the teacher promotes active learning through discovery.

The research also showed that the push to integrate digital technologies into Senior Geography by NZQA and, therefore, by default the schools, could be detrimental to the teaching of Senior Geography. The participants again referred to the low level of digital literacy of the students and themselves as a barrier to using digital technologies to enhance the teaching of Senior Geography as a subject. Combined with the emphasis of gaining NCEA credits, it meant that participants were forced to deliver the Geography content in a more traditional format to ensure that the students are able to pass NCEA assessments. Though the literature review does not specifically mention gaining NCEA credits, it does refer to integrating digital technologies into the Geography curriculum, which is seen in the literature review as a 'double innovation' problem (Johnson et al., 2016). Not only do the participants have to learn how to use digital technologies, but they also have to make them appropriate to deliver the content. It is therefore not surprising that, with the combination of both participants' and students' levels of digital literacy and the demands of the NCEA, the participants default to substituting digital technology with traditional methods of pedagogy.

The availability and the connectivity of digital technology was also discussed as a reason for digital technologies not producing a significant change in the participants' teaching of Senior Geography. The participants spoke of issues surrounding laptops, Wi-Fi and apps. The variation in laptops provided by the school and BYOD was a significant issue as it meant that apps such as Google Earth tend to work differently on different devices. Most schools who have a BYOD policy advise the students what devices to bring, but the policy is for a generic device which may not support apps that are geared for Senior Geography. This *carte blanche* approach (Wood, Mueller & Specht, 2005) by the schools does not take into consideration the needs of the participants who are trying to implement digital technologies into Senior Geography. The participants spoke about having to be competent in the many digital technologies, especially laptops, in order to ensure that the apps worked and, therefore, the lesson would be successful. The expectation that the participants could move from one device to another, assisting the students to overcome any issues with the apps, is an unrealistic one and again backs up the suggestion that digital technologies are being

implemented at the expense of teaching Geography. The fact the participants felt that it was their responsibility to be able to know how the apps like Google Earth would work on the student devices again aligns with the traditional classroom approach, which is not the expectations of the socio-constructivist classroom as outlined in the literature review. These factors also compound the perception of the participants that integrating digital technologies such as Google Earth is impractical and unworkable. These sentiments were echoed in the literature review which added that issues with Wi-Fi connection created poor student engagement (Patterson, 2007).

The concern of the participants about the unreliability of access to the laptops and the issues with connectivity are another reason why the implementation of digital technologies is kept at a low level in Senior Geography and, as a result, their pedagogy is little affected by it. These findings link in with the literature review, where participants who have negative experiences with using digital technologies in their class are less likely to use them (Ertmer, 2005) or use them in a superficial manner. The variation in the type of laptops used was not the only issue that the participants discussed. They also expressed concerns about availability, with regard to students bringing their devices or the participants relying on the use of shared computer suites or computers on wheels (CoWs). In schools where there is an expectation that students will bring their own devices and the school policy is that digital technologies are incorporated into the Senior Geography curriculum, issues are created for the participants in terms of pedagogy. Participants commented on how they cannot rely on the students bringing their devices and, with the competition within the school from other teachers wanting to use the resources, the participants cannot guarantee that they will have a full set for class. Often the school devices are damaged, missing keys or just broken and then, coupled with the Wi-Fi issues, participants are forced to have a backup plan, which generally results in resorting back to the traditional classroom pedagogy. One participant, whose school does expect laptops to be used in every lesson, described how the Wi-Fi was down for three days and, as a result, the expectation of the school for inquiry learning was unworkable.

In order for the participants to fully implement digital technologies into their Senior Geography curriculum in a manner which will change their pedagogy there would have to be a significant financial input from the schools to provide both the hardware and to maintain a consistent Wi-Fi connection. In addition, the type of laptops used by the students' needs to be consistent, but this is unlikely, as the cost of maintaining and purchasing sufficient laptops is not within school budgets. Also, insisting on laptops which could support GIS and specific geographical apps in the students' stationery lists is unrealistic. Parents, especially those who have more than one student who needs a laptop, are likely to buy the cheaper models like Chrome Book which generally cannot support the majority of the functions, including aspects of Google Earth. Consequently, it is understandable that the participants are just substituting traditional methods of teaching with digital technologies and the students are using the laptops in low level activities like word processing. These issues with availability and connectivity are not unique to the participants of this research, as in the literature review similar issues were discussed along with the detrimental effect they had on pedagogy (Morgan &

Tidmarsh, 2004; Selwyn, 2014; Whalley et al., 2014). Indeed, Johnson et al. (2016) concluded that these issues were too great for the individual teacher to overcome and, as a result, teachers would opt to avoid using digital technologies. As one of the participants in the study admitted “We don’t use BYOD as much as people think” (Participant Four).

2. How have digital technologies changed the nature of student learning?

This section concentrates on the answers provided from the interview questions 2 and 6 and looks at how students learn. There were two distinct themes that emerged from the findings of this research: firstly, student engagement within Senior Geography when using digital technologies and, secondly, issues arising from students using digital technologies in Senior Geography.

Student engagement within Senior Geography when using digital technologies

There are strong arguments in the literature review (Chapter Two) concerning the advantages for student engagement in using digital technologies in Senior Geography. The literature review highlighted the different approaches to learning now available, such as online chatrooms, internet research, quizzes, YouTube and a variety of applications designed to engage the students. The literature review also commented that students today are likely to be more motivated, not as teacher dependent, and more active and engaged with their peers and teachers in a variety of different digital formats. This, it is argued, creates students who are lifelong learners and eager to explore different possibilities in pursuit of knowledge (Fuller, 2006; Lynch, 2016; Page & Christian, 2009; Patterson, 2007).

The reality shown in this research is far from the utopia as described in the literature review, in that student engagement varied depending on the classroom activities and/or the outcome of the lesson. Participants noticed that the students were engaged in visual resources such as videos on YouTube or Netflix or with quizzes from Kahoot! Participants also referred to the students being engaged when the lesson was perceived as being ‘fun’ and that the participants were eager to produce lessons that were ‘enjoyable’, words also used in the literature review to show how digital technologies can improve student outcomes (Lynch et al., 2008; Page & Christian, 2009; Prensky, 2001; Willis, 2007). Though the lessons in Senior Geography should be interesting, as this then sparks curiosity and leads to developing critical thinking about geographical issues and geographical skills, there is a concern that concentrating on the ‘fun’ activities detracts from the actual learning. If the students are constantly doing quizzes they are not developing critical thinking skills. To be able to critically think the students need to have specific geographical knowledge which they acquire through a variety of different activities, which do not necessarily have to be on digital devices.

Though some of the participants were enthusiastic in their answers regarding student engagement there was also the concession that students are distracted by aspects of digital technologies during their Senior Geography lessons. The findings in this research also showed that there was a link between the aim of the lesson, student ability and engagement. The participants noted that the students with higher academic ability tended to be more engaged and there was an increase in engagement throughout the

class when they were working towards NCEA credits, although the minority of students who were struggling with the content of the assessment would be the ones who were more distracted. Students are able to hide behind looking busy on digital technologies when the reality is that they are engaged in non-academic activities. This shows there is a direct link between the perception of the student and the value of the lesson. Where the lesson was linked to gaining credits, and therefore passing NCEA, they were engaged, but they were more distracted during the lessons where the content was being delivered. This shows that the students are aware that they can obtain the Geography content at any time through the online platforms or the internet itself but, more significantly, it also shows how the students perceive the importance of gaining knowledge. Within this research and the literature review, concern was raised about the students' lack of curiosity and wonder and the implications that this would have for solving the 'wicked' problems of the 21st century (Bull & Gilbert, 2012).

The findings in this research study raise an interesting point concerning the acquisition of knowledge. The arguments for the inclusion of digital technologies into Senior Geography within the literature review state the benefits for the students in creating new knowledge through discovery learning (Henry, 2014; Page & Christian, 2009). However, this research shows that, if the students do not have prior geographical knowledge, they have no starting point from which to start discovering new information. One participant voiced their concern over the lack of basic geographical knowledge and pondered over the fact that students today only learn what they have to. This relates to the concept of the students being 'cognitive misers' as described in the literature review (Leslie, 2014). It is also going to be difficult to change the pedagogy into a student centred learning environment, where they build on existing knowledge, if the students are in fact the empty vessels which Freire (1970) spoke of, where they are relying on the internet or online platforms to provide them with geographical knowledge. Indeed, the findings in this research suggest that students are not actively developing independent learning skills but, more worryingly, have a lack of knowledge of their own environment. The participants spoke about the students having some knowledge of global issues but lacked the curiosity and imagination to fully explore the environment. Social media and the internet link students instantly with different parts of the world and, as a result, the excitement of exploration has disappeared. Added to this is the fact that the internet offers a lot more exciting elements to keep the students entertained and distracted.

The common forms of distractions tended to be accessing social media, playing music videos on YouTube and accessing games like Minecraft. Students will take any opportunity to be off task, especially those students who are struggling with the knowledge content, but realistically this has always been the case with students long before the introduction of digital technologies. Though the students appeared to be 'digital natives' (Judd, 2015) when it came to the educational use of digital technologies, the participants noted that they were 'digital immigrants' (Judd, 2015) when it came to accessing apps that the school was blocking in order to deal with the distractions. Ironically, it is these apps that are distracting the students that the literature review sees as ways of getting them engaged in Senior Geography, especially

when referring to encouraging collaboration and developing metalanguage when engaged in geographical discussions in chatrooms (Page & Christian, 2009; Patterson, 2007).

Participants also commented on the ability of the students to research and the availability of resources. The perceptions on both of these aspects were varied. Some of the participants saw them as assets and felt that, as a result, the quality of the students' engagement and work had improved. They saw this as a direct result of having the resources available. Conversely, other participants showed concern at the lack of research skills and a need to having to point the students in the right direction in order to keep them on task. The standard of the work produced was also a cause for concern and participants noted the issue of plagiarism in the Senior Geography work. This then links with the literature review where Lynch (2016) refers to the fact that students do not see the problem with cheating in examinations and consequently they fail to see the issue with plagiarism. In turn, all this links in with the idea of the students' perception of the importance of knowledge. If the student does not value knowledge, as it is something that can be accessed easily from the internet and all they have to do is prompt the internet and the knowledge will be provided. There is, therefore, no need for them to learn it and, because they have retrieved it, this means they can use it without thinking about its content. The literature review asked the question 'who is doing the remembering the student or the internet?' and from the responses in this research it would appear that the answer is split. Though Loveless & Williamson (2013) would argue that, by the student knowing which site to go to in order to access geographical content which they can then adapt to their work, this shows that they are competent in internet research skills. If the students are plagiarising, however, this surely shows that the students are not confident in their own understanding of the geographical content.

Issues arising from students using digital technologies in Senior Geography

The participants in this research spoke about their concern over the level of basic literacy and numeracy abilities of the students and they attributed the poor level of skills to the use of digital technologies. One participant explained how their school was so concerned about the literacy levels of the students and their ability to write essays, which is needed for the NCEA external examinations that the school policy was for students to write for at least 30 minutes each lesson. There was an agreement amongst the participants that the word processing and graph apps were doing the work for the students and this then created issues for teaching and learning in Senior Geography. The literature review, however, does not specifically speak about the issue with basic numeracy and literacy and this is probably because there is an expectation that by senior school the students should have a grasp of these elements. This research has indicated that this is not the reality for these participants. Granted there are certain graphs unique to Geography, such as climate graphs and population pyramids, and teachers have always accepted that it is their responsibility to teach these. The concern raised by the participants is how the students are struggling with basic numeracy and literacy and this has implications for teaching Senior Geography. If the participants are having to teach these skills before teaching the Geography content, then it is going to

be difficult for the students to develop high level critical thinking skills. Further research is therefore needed to see how students' basic literacy and numeracy is being affected by the implementation of digital technologies.

Both the literature review and the participants in this research discussed the issue of students accessing digital technologies, especially laptops and the internet (Morgan & Tidmarsh, 2004; Selwyn, 2014; Whalley et al., 2014). The laptop has become a significant tool for the students, especially for some of the participants where there is an expectation that they are used in every Senior Geography lesson. The participants spoke about the students having to have access to the Geography content through a variety of mediums and to be able to access it at any time. This research highlighted that not all the students have access to laptops and Wi-Fi and this was a concern as it does create what is termed in the literature review as the 'Matthew Effect' (Illich, 1971). The 'Matthew Effect' means that some students have access while others do not, and this disparity means that some students can only access their Senior Geography work in school. This puts pressure on them to complete their assessments in the time allocated, which can result in the students prioritising what they are doing in class. If an assessment for another subject is due then they may use their Senior Geography time to finish off the assessment leaving the Senior Geography work till later. This creates an unfair advantage for the 'haves' who are then more likely to academically achieve. The participants discussed how they were more flexible and showed they had an understanding of this situation by having a combination of methods in their Senior Geography classes which relied on student preferences. Students could choose either to use digital technologies like laptops or they could use worksheets and exercise books. This duplication does mean additional work for the participants but it is an attempt to address the 'Matthew Effect'. A further issue with the 'Matthew Effect', however, is that those students who do not have regular access to digital technologies need to play catch up when they do have access to them, especially in the school environment, where increasingly participants are using email to keep the students up to date with information. Access during Senior Geography lessons may be one of the only opportunities they have to access emails and receive notices. This distraction then creates a spiral effect as the students are not concentrating on their work and have to make up that time later.

At the heart of these issues, however, is the different way in which the participants and the students view the use of digital technologies. For the participants, digital technologies in the school are an educational tool, which ultimately help to improve the academic achievement of the students. For the students, however, digital technologies are a means of communicating with their friends and entertainment. The participants referred to how the students are engaged with their smart phones, but realistically it is likely that they are using them for social media and gaming.

3. In what ways are teachers and students using digital technologies in Senior Geography and what are the implications for the future of the subject?

For this section the findings primarily from questions 2, 3 and 8 will be used, though there was overlap during the interviews as the participants were encouraged to speak freely. The questions aimed to probe how digital technologies are used in Senior

Geography and how the participants see the implications of implementing them for the future of the subject.

How digital technologies are currently being implemented into Senior Geography

When looking at the types of digital technologies the participants are using in Senior Geography (Table 4.2), there is a lack of specifically geographical apps being employed. Only two participants referred to the use of Google Earth and only one participant referred to Google Maps and Google Cardboard. For fieldwork, smart phones for videoing the teacher and photographs were the most common, while one participant did refer to allowing their students to use social media in the form of Snapchat for data collection. One participant had used digital decibel and anemometers for data collection. The SAMR model discussed in the literature review explains how digital technologies should be used to enhance the subject (LaCruz, 2018), and how Senior Geography participants should be using specific geographical digital technologies. The findings in this research study clearly show that the participants are in the enhancement stage, where they have substituted or augmented traditional teaching and learning with digital replacements. If the participants are to fully implement digital technologies into Senior Geography, however, then they will have to think how they can use digital technologies to enhance the subject and this means becoming familiar with Google Earth and GIS programmes.

The participants in this research study, therefore, have substituted traditional teaching methods by replacing them with digital technologies. In this research study participants spoke about their use of PowerPoints and for four participants they were crucial in their teaching. One participant spoke about constantly using PowerPoints as this ensured that the students would get Geography content and they were, therefore, a form of safety net. PowerPoints are a substitute for textbooks and worksheets and to some extent for teaching (LaCruz, 2018). The teacher has all the information on the board and the students just have to read from them. Often the PowerPoints are shared with the students, and teachers print off the slides so the students can annotate them with extra notes. PowerPoints are another form of presenting information and can help engage the student but if the students are constantly working from PowerPoints is this truly enhancing Geography as a subject?

There also appears to be a misconception with the participants in this study as to what it means to implement digital technologies into Senior Geography. The participants appear to believe that by using online platforms like Google Suite, apps such as PowerPoints, YouTube and online quizzes, they are fully implementing digital technologies. One participant spoke about feeling left behind as they could not use Google Suite and how they needed to develop the skills with which to use it. This links in with the literature review where Wikramanayake (2005) and Lacruz (2018) refer to the levels of teacher ability and perception, in that teachers believe that they are competent in aspects of digital technologies but in reality they are only using them at a low level. This misconception is not entirely the participants' fault, as there is a perception within society that students sitting in front of laptops busy typing away like a parody of a 1950's typing class is how a 21st century classroom should be. This misconception is compounded by the wishes of school managers, who expect students

to be working on laptops each lesson, a fact referred to by the participants in this study. The participants are also constrained by the lack of PD, NCEA assessment criteria and other issues such as cost. It is therefore not surprising that the findings in this research show a bias towards using digital technologies at the enhancement stage of the SAMR model and there is little movement towards the transformation stage (Lacrux, 2018).

The literature review referred to the commitment of the New Zealand Government and, therefore, by default of New Zealand schools, to ensure that students in the 21st century are competent in using digital technologies as this is vital for the students if they are to meet the dynamic needs of the 21st century workplace (Beetham & Oliver, 2010; Benade, 2015; Blaschke, 2012; Network for Learning Team, n.d; Lynch, 2016). Part of the policy to ensure that the students have access to digital technologies, including in Senior Geography, is the introduction of the BYOD policy. The results in this research study showed that the implementation of the BYOD policy varied from the casual approach to a stricter 'it's expected now' line. This variation in the expectations of the schools has implications for Geography and the implementation of digital technologies into the subject. One participant showed concern that the students at their school were being left behind as the technology changes so quickly and they are not using it as much as other schools. This compounds the 'Matthew Effect' for students in the participant's school (Illich, 1971).

Table 4.2 (Chapter Four) shows that four of the schools use online platforms. Online platforms are where a variety of software programmes are grouped together for easy access and are linked, for example Google Suite, which contains Google Classroom, and Google Forms. Schools tend to choose the online platform that fits best for them, without considering the needs of the specific subjects, including Senior Geography. As a result, the participants are expected to fit the Senior Geography programme into this format. As referred to in the literature review, this carte blanche approach (Johnson et al., 2016) can affect how participants use digital technologies. If there is an expectation from the school for the participants to use the prescribed digital technologies such as the online platforms, then this will make the application of digital technologies into Senior Geography the same as any other subject and, therefore, fails to enhance Senior Geography. In this light it is not surprising that the participants feel that they are fully implementing digital technologies into Senior Geography as they are using the various aspects of the only platform provided, and that there is little movement from the enhancement to the transformation stage (Lacrux, 2018).

The implications for the future of the subject

Throughout the literature review there is an emphasis on the significance of digital technologies in the 21st century. The expectation is of students being able to use digital technologies at a high level and for this to result in a change in the pedagogy from being teacher led to student led (Bull & Gilbert, 2012; Hurley et al., 1999; Wikramanayake, 2005). The findings in this research study, however, show the participants have a different perspective. When discussing the future of digital technologies in Senior Geography they did not envisage scenarios where digital technologies had reached the transformation stage (LaCrux, 2018), where the teaching

and learning would be delivered in a manner where the students were integrating a variety of high level digital technologies to produce new knowledge but, rather, simply envisaged adapting the digital technologies they already have. Although it could be argued that Senior Geography has an advantage over other subjects, in that there are Geography apps already available that people use every day like Google Maps, the participants could not see beyond the low level use of digital technologies.

The findings of this research study also show a similar pattern for the use of digital technologies in fieldwork. The use of digital technologies to collect, collate and present the fieldwork data were the focus of the discussions. Although the participants agreed that there was a need to implement more digital technologies into the fieldwork, the discussions tended to refer to substituting traditional methods with digital alternatives, instead of fieldwork booklets the students would record the data on spreadsheets on iPads. There was no discussion on how they would change the activities in order to transform the fieldwork and one participant spoke about the issue of the domain of fieldwork in their school as it is only the Science Department who are to go out and collect measurements. This is a concern as fieldwork is intrinsic to Senior Geography (Fuller, 2006 p.215), and could be the easiest way of integrating high level digital technologies into the subject as well as changing the pedagogy of the Senior Geography teachers from a traditional approach to a socio-constructivist approach.

One strong positive from the findings was that the participants felt that going out and collecting the data was important and could not be replaced by virtual fieldwork, although one participant did suggest that virtual fieldwork could be used when going to places would be difficult, which does align with the literature review, in which the benefits of virtual fieldwork were discussed (Cliffe, 2017; Fuller, 2006; Henry, 2004; & Lynch et al, 2008). The participant, however, did not expand on what the students would be doing in the virtual fieldwork world that would enhance geographical knowledge. The idea was that the students would 'visit' the places and the overall feeling was that virtual fieldwork was a backup, thus not recognising the potential of using virtual fieldwork to practise skills and compare similar environments before setting out on actual fieldwork.

The findings in this research showed that there were still barriers, from the participants' perspectives, to implementing digital technologies into Senior Geography and the most significant was the digital literacy of both the student and the participant. There was agreement that in order for the more consistent implementation of digital technologies within Senior Geography, then both students and participants needed to be digitally literate as well as having equal access to similar digital technologies. There was consensus amongst the participants that this imbalance impacts the teaching and learning in Senior Geography and, as a result, until the balance is addressed the situation is unlikely to change. One participant referred to the socio-constructivist concept of student led lessons but saw that as impractical while there were these disparities.

In the literature review, although the 'luddite' teacher (Howard & Mozejko, 2015) was said to be responsible for the lack of implementation of digital technologies in the 21st

century classroom, the participants were generally enthusiastic, if not a little cautious, towards using them. In addition, one participant did also mention that not every student was keen on using digital devices. The participants agreed that using digital technologies in Senior Geography was another tool and that teaching Senior Geography should not be limited to just using digital technologies. The nature of Senior Geography is that it is a 'hands on' subject where there is the expectation that students will use a variety of skills and tools to interpret the environment.

The participants in this research study also reflected on the future of Geography with regard to the expectations of NZQA. Though the findings showed a positive reaction from the participants towards using digital technologies with the students in internal assessments and moderation, there was concern about how NZQA intended to implement digital technologies into external examinations. The literature review refers to the nature of Geography as a subject in which a variety of skills are needed to succeed. These skills include mapping and graphing skills, such as interpretation and drawing, field sketches and diagrams, skills which can all be accomplished using digital technologies with the appropriate software. Unfortunately, the participants in this study would find these difficult to access due to their digital literacy levels, as well as the schools not being able to afford the suitable digital technologies. Students taking Senior Geography are expected to be able to perform these important geographical skills but to present them in a paper format. The concern from the participants in this research study is that if the Geography skills external examination were to be digitalised then it would reduce Geography to a comprehension study. In addition, there are disparities already in the participants' schools regarding access to digital technologies and, if NZQA made the geographical skills paper digital, then this would compound the 'Matthew Effect' across the schools. Just as significantly it would undermine the nature of Geography as a subject – are we testing the students on their geographical skills or if they can use digital technologies? The participants have already seen a decline in the standard of the literacy and numeracy skills of the students and there is a concern that something similar could happen to Geography skills. This discussion links in with the literature review, where there was a concern that digital technologies were being implemented without regard for pedagogy (Wood, Mueller, & Specht, 2005) but the participants expressed a similar concern about digital technologies being implemented without thought as to how it could be to the detriment of Geography as a subject.

The requirements imposed by NZQA are a further reason as to why the participants in this study are only implementing digital technologies at the enhancing stage of the SAMR model. The participants have to conform to the instructions given by NZQA for each of the Senior Geography internal standards. These standards use terms such as 'comprehensively', 'evaluate', 'discuss', 'analyse', 'explain' and 'describe', and the students have to show understanding and insight, and use geographical concepts and keywords. The students work is then marked against criteria that focus on the level of their knowledge and understanding. As a result, the participants resort to essay writing, and feel the need to ensure that the student has the necessary content to meet the strict criteria imposed by NZQA. The students' work will also be moderated by

external moderators from NZQA, who will critique the marking of the participants and give feedback. The external moderators are looking for evidence that the students have met the Geography standards' internal assessment criteria and, therefore, the marking of the participants is up to NZQA standards. Reports from the external moderators and best practice advice are always in the form of exemplar essays, which the participants will have access to and, though NZQA do suggest that the students can present their work using digital technologies such as videos, the easiest option for the participants is to default to essays. This is again an example of substitution rather than transformation.

The participants in this study also mentioned the significance of credits and this could also be another factor as to why the participants choose to focus on essays in Senior Geography. The expectation from senior management is that the students gain at least 14 credits in Senior Geography. Participants are under pressure to gain over 75% pass rates for their classes and have significant endorsement pass rates within the class. This number fluctuates as it tends to be based on previous years. Participants will have to account for their failure to meet the targets set by the school at the end of the year. This then forces the participants to focus their pedagogy on ensuring the students are meeting the criteria of the standards so they gain the credits. This then further explains the reluctance of the participants to actually 'take a chance' on those standards like the 'point eights', in which they have little confidence. It is therefore not surprising that the participants are using digital technologies at the substitution level and cannot see the potential beyond this when there is no incentive from NZQA to develop high level digital technologies in Senior Geography and the focus from school management in Senior Geography is on gaining credits. Until this changes, a paradigm shift is unlikely.

Summary

Chapter Five has critically examined the participants' experiences and perceptions regarding the implementation of digital technologies into Senior Geography. In addition, the themes that emerged from the research have been discussed and analysed in relation to the literature review in Chapter Two. In order to address the aims of this research, the findings were explored and discussed through the use of three questions. The discussion that focused on these questions helped to address several issues: firstly, how digital technologies are being used in Senior Geography and how this has influenced pedagogy; secondly, how teaching and learning are influenced by the implementation of digital technologies; and, thirdly, the implications of the use of digital technologies for the future of the subject.

The final chapter will clarify the conclusions of this research, explore its strengths and limitations, and make recommendations for future practice regarding the implementation of digital technologies into Senior Geography. The final section will offer suggestions for further research.

Chapter Six – Conclusions

Chapter Six will begin its summary of this research study by presenting a brief overview of the research aims and methods. This will be followed by a discussion of the implications of the findings from this study and an examination of the way in which these findings contribute to knowledge. Recommendations will then be offered on how the key findings can be applied in practice and a review will be made of the strengths and limitations of this research study. Finally, suggestions will be made for further research.

Overview of the research

This research study was designed to investigate the perceptions of Senior Geography teachers regarding the use of digital technologies in their subject and the influence of this on their pedagogies. In addition, it aimed to investigate which digital technologies are used in Senior Geography, how teaching and learning have changed as a result of their use, and the implications of this for the future of the subject. This study employs a qualitative approach and follows a constructivist paradigm. The data for this research was collected through interviewing six Senior Geography teachers who have had at least two years' experience of teaching Senior Geography in New Zealand schools. The findings from the interviews were presented, and then discussed with reference to the relevant literature. This chapter will set out the conclusions reached from this research process.

Conclusions

The following section will discuss the conclusions from this research study in relation to each of the three sub-questions, which were formulated in order to address the aims of the research.

1. How has Senior Geography teaching changed with the implementation of digital technologies?

The expectation in the 21st century is that, with the implementation of digital technologies into Senior Geography, there will be a change in the classroom dynamics from being teacher led to student led. It is expected that the students will gain new geographical knowledge through innovative activities incorporating exploration, problem solving and critical thinking (Bull & Gilbert, 2012; Selwyn, 2014; Wikramanayake, 2015). This research study has shown that there are a number of factors that, collectively, have impacted pedagogy in Senior Geography with regard to implementing digital technologies and these are discussed below.

In terms of interaction with the student, this research has shown that there has been a change in how Senior Geography teachers relate with their students. Though the expectation would be that the interaction would be through a variety of digital technologies, the indication from this research is that it is more likely to be through Google Docs and email. Digital technologies have allowed the Senior Geography teachers to instantly access the students' work and, as a result, give feedback and

feedforward instantly. There was caution in the findings, however, that this easy access to the Senior Geography teachers is creating an issue with work life balance. The findings show that the expectation from the students is that this interaction means that they can contact their Senior Geography teachers at any time and there is an expectation that their teachers will respond. Linked to this is the expectation that the Senior Geography teachers will upload the relevant Geography content to the online platforms. This result is not what the literature review anticipated and, as a result, shows an unexpected reality. This result shows the reliance the students still have on their Senior Geography teachers as being the holders of knowledge, and the conclusion is that the students are not yet ready to meet the challenges of the 21st century with regard to taking control of their education.

From this research it can be concluded that there appears to be little change in pedagogy. Although the Senior Geography teachers seem to believe that they are implementing digital technologies, in reality they are substituting one traditional method of delivery for a digital technology alternative which produces the same outcome (Lacruix, 2018). The Senior Geography teachers are still organising the lessons and delivering the geographical content. This leads to the conclusion that the Senior Geography teachers still see the need to be the holders of knowledge, as they are wary of the students' ability to access the relevant geographical knowledge themselves. This is due partly to the students' digital literacy as well as their prior geographical knowledge, but also to an apparent lack of understanding as to how digital technologies can be implemented into Senior Geography in order to enhance the subject.

In terms of using digital technologies, this research study showed that there were issues with the variations in devices that the students bring to Senior Geography, as well as the devices available to the teachers. The literature review discussed how, if there are negative experiences of using digital technologies in the classroom, then there is likely to be a small uptake by the teachers in using them. The disparities in the types of devices, the reliability of access to the devices and connectivity issues all combine to create the perception of the unreliable nature of using digital technologies within Senior Geography. As a result, if they cannot guarantee all the students will have devices that will work and can perform the tasks of their lesson plan and there are doubts that the Wi-Fi will be connected or issue free, then it is not surprising that they are not relying on using digital technologies on a regular basis or prepared to experiment with them in order to introduce the 'point eights' or for the enhancement of the subject (Ertmer, 2005).

As far as teacher engagement and ability are concerned, the results of this research lead to the conclusion that, although the Senior Geography teachers are proficient in low level digital technologies such as word processing, there is a distinct lack in higher level digital technology skills such as incorporating GIS, and there is also a lack of confidence, which hinders the implementation of digital technologies into high level activities. Though there was no issue with the Senior Geography teachers going on PD, there appeared to be no communication from outside agencies or from within the schools as to the various courses that are available. The expectation that the Senior

Geography teachers will organise their own PD leads to the conclusion that schools themselves are content with using digital technologies at a substitution level. There seems to be no push for the Senior Geography teachers to develop their digital technology skills further in order to transform the Senior Geography curriculum by using high level geographical software like GIS, and to thus provide the students with another digital tool with which to meet the needs of the 21st century.

This research study also found that there was a contradiction relating to the levels of student digital literacy and, as a result, this influenced the participants' pedagogy. The impression in the literature review, and the perception of society, is that students are the 'digital natives', and that it is the teachers who are playing 'catch up' (Judd, 2015). The reality from this research is that, in terms of using digital technologies for educational purposes, it can be concluded that students are not digital natives at all, and the Senior Geography teachers are having to teach the students basic digital skills. This leads the teachers to conclude that there is no point in actually attempting to engage in higher geo-technic skills within Senior Geography, as the students will not be able to cope and, therefore, will make little academic progress in the subject.

The requirements of NZQA, through the Senior Geography NCEA standards, were also a significant finding in this research study in terms of their influence on pedagogy. The nature of NCEA standards, combined with the expectations of both student and SLT, have resulted in the Senior Geography teachers focusing on delivering content. Consequently, they use digital technologies to present content rather than to explore different ways of using them within the subject. In addition, this emphasis on content maintains the 20th century style of teaching, where the teacher is the holder of the knowledge and the student is the empty vessel waiting for the knowledge to be poured in (Freire, 1970). This rigidity within the NCEA standards is not complimentary to the socio-constructivist concepts of education and, as a result, stifles the Senior Geography teachers into relying on low level digital technologies in order to deliver the content so that they meet the needs of NCEA. The conclusion must be that, if the Senior Geography teachers are working towards that agenda, there will not be any significant change in their pedagogy.

The findings of the research with regard to the implementation of BYOD highlighted two findings. Firstly, the differences in policies across the schools in how the BYOD policy was implemented and, secondly, the response of the students to the BYOD policy. There were disparities in how the schools operated BYOD, which resulted in variations in the impact on the pedagogy of the Senior Geography teachers. Where there was an expectation of the teachers using the devices, then this would be incorporated within their planning and would result in changes to their pedagogy, while in schools where there was no BYOD policy there would be no changes to pedagogy. Similarly, the response of the students to the BYOD policy would also affect the pedagogy of the Senior Geography teachers. This research showed that there were disparities in the response from students to actually bringing in their devices and then having to rely on school based digital technologies if they did not comply with the policy. In addition, the students brought in a variety of different devices, some of which could not support the apps or programmes in the way the Senior Geography teachers

expected. The teachers were then expected to be able to solve any issues which arose during the lesson. This situation was highlighted in the literature review, where the task of implementing digital technologies is seen as too great and, as a result, there is the rejection of implementing them into Senior Geography (Ertmer, 2005). This supports the conclusion that it is essential to have a cohesive policy within schools with regard to BYOD, in order to ensure that there is a change in the pedagogy which will lead to the full implementation of digital technologies into Senior Geography.

One subtle finding in this research is the perception of what the Senior Geography teachers believe it means to fully implement digital technologies into their subject, and this leads to the conclusion that there is a misunderstanding of exactly what this entails. Currently, the Senior Geography teachers are concentrating on introducing low level digital technologies such as PowerPoints, YouTube videos and quizzes and, though there is nothing wrong with that at this stage, there needs to be a vision of what Senior Geography will look like in the future. The current misconception is that if they use more PowerPoints, quizzes and YouTube in every lesson, then they are fully implementing digital technologies into Senior Geography. This misconception does not align with the literature review or the aspirations of the socio-constructivist classroom and, as a result, shows that there will not be any significant changes in either the participants' pedagogy or the nature of Senior Geography in the near future.

2. How have digital technologies changed the nature of student learning?

The literature review supports the perception in society that the students are digitally literate and are willing to use digital technologies for educational purposes. There is also the belief that the classroom is evolving, where the students are not teacher dependant but are taking ownership of their own learning, a vital 21st century educational skill (Fuller, 2006; Lynch, 2016; Page & Christian, 2009; Patterson, 2007). The findings in this research study, however, point to the conclusion that this aspiration is not yet a reality.

This research study found that there were variations in student engagement, and these were centred around the aim of the lesson and the activities which the students were participating in. If the activities were seen as 'fun' (Lynch et al., 2008; Page & Christian, 2009; Prensky, 2001; Willis, 2007), such as visual tasks like YouTube videos and quizzes and, if the students were working towards credits, then there was an increase in engagement. On the other hand, if the lessons were centred around activities geared towards gaining geographical knowledge, then there was less student engagement and the students were distracted by social media and gaming. In addition, those students who lacked prior geographical knowledge were also less engaged. These findings align with the literature review, in that students are less likely to engage in collaborative activities where they have no prior geographical knowledge (Hurley et al., 1999), and that the resulting reduction in curiosity leads to students becoming 'cognitive misers' (Leslie, 2014). The conclusion from this is that the students feel that there is no need to acquire knowledge and that they see little value in it. This conclusion is worrying, as it has significant implications for the students on two levels: firstly on building up their geographical knowledge in order to comprehensively understand the environment and, secondly, on the ability of the students to succeed in the 21st century, where there is

the expectation that their acquired knowledge will be used to solve the 'wicked' problems of the future.

The findings in this research also indicate a concern regarding the basic literacy and numeracy levels of the students. The literature review does not specifically mention this, which indicates that there is an expectation that the students at Senior Geography level have mastered basic literacy and numeracy skills. The findings from this research study contradict this assumption and show that there is a concern over the low standard of literacy and numeracy skills which is impacting the teaching of Senior Geography. The implication is clear that, if the students are unable to access the Geography content due to low levels of literacy and numeracy skills, then they will struggle with developing critical thinking skills, including collaboration. Moreover, they will attempt to avoid these activities for fear of embarrassing themselves, and Senior Geography teachers will be unable to push their students to think critically if they are constantly having to teach basic literacy and numeracy skills.

The issue of accessibility of devices for the students outside the school environment was also an issue highlighted in the literature review. The literature review referred to the 'Matthew Effect' (Illich, 1971), and the findings in this research suggest that this is a genuine issue. With the increased expectation that the students are to use digital technologies, especially laptops, to access and complete their Senior Geography work, a disparity has been created. Students who have access at home have a significant advantage over those who do not in terms of completion of work. Those who do have access also have the advantage of being able to contact their Senior Geography teacher and classmates for clarification on the expectations required to complete projects, while those who do not have access are constantly playing catch up. The conclusions of this research have shown that, in order for digital technologies to be fully implemented into Senior Geography, there has to be equality, not only of accessibility to devices, but also in the ability to use them. The implications are that, while there are these disparities, fully implementing digital technologies into Senior Geography at both low and high levels is unworkable.

Overall, this research study has led to the conclusion that there has been little change in the nature of how the students learn. There are concerns about the ability of the students in regard to digital literacy, literacy and numeracy skills and prior geographical knowledge. This, coupled with the issues of accessibility to digital technologies, shows that fully implementing them into Senior Geography to create a socio-constructivist classroom is currently too difficult and adds to the reasoning as to why there has not been a dramatic shift in pedagogy.

3. In what ways are teachers and students using digital technologies in Senior Geography and what are the implications for the future of the subject?

The findings of the research study in terms of how digital technologies are being used in Senior Geography show that, while they are being used, this is generally at a low level. With regard to fieldwork, the research study showed that actual fieldwork was preferred over virtual fieldwork and, though virtual field work was not dismissed, it was

seen as a means to compliment actual fieldwork. Though the implementation of digital technology within fieldwork was at the substitution level, there was a move towards visualising different aspects of using digital technologies within fieldwork. Geography fieldwork is more open to experimentation than classroom Geography, where the rigidity of NCEA does not allow for experimentation. Therefore, any significant changes in regard to implementing digital technologies into Senior Geography is likely to come via Geography fieldwork.

Concerning NZQA and the future of Geography as a subject, the conclusions from this research are clear. NZQA, in particular the Geography assessment outlines in NCEA, do not promote the use of digital technologies to enhance Senior Geography as a subject. Indeed, the strict assessment criteria can be seen as a barrier to the implementation of digital technologies within Senior Geography, as they are unforgiving in terms of allowing experimentation for students to present their work. Currently, NZQA are still thinking in the terms of the 20th century and, until there are changes, there is no need for the Senior Geography teachers to upskill to become more digitally literate in specific geographical software.

The narrow vision of gaining credits is also a hindrance to the implementation of digital technologies within Senior Geography and is the opposite of the socio-constructivist classroom as discussed in the literature review. This research has clearly shown that the Senior Geography teachers are concerned with delivering geographical content in order for the students to gain credits, rather than allowing the students to take charge of their own learning and this is not the fault of the Senior Geography teachers but rather the fault of NZQA. The conclusion, therefore, has to be that, while Senior Geography teachers are at the mercy of NZQA and there is no change from them, then there will be no change in how digital technologies are implemented into Senior Geography.

Overall, this study has shown that, though digital technologies appear to have been implemented into Senior Geography and there is enthusiasm for their use, the implementation is still at a low level. This is due to a variety of limiting factors, including the digital literacy of the students and teachers, school policies, the lack of access to a variety of digital technologies, and significant differences in the devices, which often makes using them unworkable. Though there is enthusiasm amongst the Senior geographer teachers to experiment and use digital technologies in Senior Geography, there have been only slight changes in pedagogy as a result of their implementation. The issue is that until NZQA, school management and Senior Geography teachers understand the true definition of fully implementing digital technologies into their subject, there will be no change, and the concerns echoed in the literature review of a *carte blanche* manner (Wood, Mueller, & Specht, 2005) in which digital technologies are introduced into schools with regards to pedagogy will be vindicated.

Recommendations

There are three main recommendations that follow from the conclusions of this research study. The recommendations may be thought of as 'blue sky thinking', are costly and will take time, yet to fully implement digital technologies into Senior Geography in order to enhance it as a subject and to meet the criteria for a socio-constructivist classroom to meet the needs of the 21st century, there needs to be a radical approach.

Recommendation one

The first recommendation concerns equality of access to digital technologies. In order to fully implement digital technologies into Senior Geography there has to be a higher standard of digital literacy for both students and Senior Geography teachers. Digital literacy should be taught to the students separately and there should be an increase in the PD offered to Senior Geography teachers. The expectation should be that the students and the teachers come to Senior Geography classes and concentrate on using digital technologies in a manner that transforms the nature of the subject, rather than expecting Senior Geography teachers to teach basic digital skills to the students. In addition, equality also refers to access to digital technologies, in that there should be no disparities in the digital technologies used by either the Senior Geography teachers or the students. This recommendation has serious implications for both the New Zealand government and schools, in terms of funding and curriculum development, costs of upgrading digital technologies for schools and funding for students in terms of BYOD. However, if the New Zealand government is committed to fully implementing digital technologies into Senior Geography, there has to be equality.

Recommendation two

An important issue highlighted by this research concerns the way in which digital technologies are being implemented into Senior Geography. The recommendation here is that instead of asking 'what can Senior Geography do for digital technologies', the question should be 'what can digital technologies do for Senior Geography?' Digital technologies are being forced into Senior Geography without really thinking about how to use them appropriately and, thereby, to transform the subject. For some schools, if the students are working at laptops, then they have ticked the implementation of digital technologies box. Therefore, the recommendation has to be for a significant rethink of the Senior Geography curriculum, in which the use of digital technologies goes beyond PowerPoints and quizzes. This radical approach needs to be in conjunction with NZQA, who are responsible for creating the Geography assessment standards, and also a supportive SLT, as appropriate measures will need to be put in place to provide opportunities to implement higher level digital technologies.

Recommendation three

The third recommendation advocates the use of fieldwork as a convenient approach to introducing digital technologies into Senior Geography. Fieldwork is a fundamental part of Geography. Every geographer goes out to explore and, in the past, Geographers and explorers have embraced new technologies in order to collect accurate data and create new knowledge. Fieldwork, unlike the NCEA Senior Geography assessment criteria, is forgiving. It allows the students to make mistakes, as then they have something to

discuss! By experimenting with digital technologies in fieldwork and having back up data collection plans, both the Senior Geography teachers and the students will gain more confidence in using digital technologies and are likely to experiment with different forms of digital technologies. This then will have a knock on effect in that, as the Senior Geography teachers' confidence grows, they are more likely to transfer their new skills into the Geography classroom. This will then help to move from the enhancement stage to the transformation stage of the SAMR model (Lacruix, 2018).

Strengths and Limitations of the Study

One strength of the research process was that the interviews were individual, which allowed the participants to speak freely and not be intimidated by hearing about the success of other schools or the nature of their provision. This was important as it helped the participants to reflect on their experiences in a safe environment. It gave authenticity to their reflections and opinions and meant there was no dominant voice. However, if data had been gathered using focus groups, it may have allowed the participants to bounce ideas off each other and helped to trigger other experiences. It may also have helped the younger teachers to overcome their shyness and not be worried that they were giving the wrong answers or answering in a way that looked negative about their school.

The range of deciles of the schools was a positive factor, in that there were three decile one schools, a four, a six and a ten, and this gave quite a broad balance across the socio-economic spectrum. The dominance of decile one, however, could be seen as creating an imbalance in the responses, as there is an expectation that decile one students are likely to come predominately from a poor socio-economic environment and, in order to get a more balanced view across the socio-economic spectrum, other deciles should have been included. It could be argued, however, that if we are to have an inclusive 21st century education system where digital technologies are fully implemented into Senior Geography, then it is vital to explore the experiences in the most vulnerable schools, namely those in decile one. Just because the school is decile ten, however, it does not automatically mean that there are not students and Senior Geography teachers who are having the same issues as those in decile one. By examining the experiences and perceptions in decile one schools and formulating changes for the benefit of these schools, eventually the experiences will filter up to the decile ten schools. The priority has to be equality for all Senior Geography teachers and students if there is to be full implementation of digital technologies into Senior Geography.

The size of the sample was small, only six participants were questioned, and this is clearly a limitation of this thesis. In addition, this research study is a snapshot of what was happening in those schools at that particular moment in time. This research study is a reflection of the experiences and perceptions of the participants at the moment of the interviews and may not fully reflect the experiences and perceptions of other Senior Geography teachers across New Zealand. Obviously, a larger sample would provide a greater variation in the perceptions and experiences, but it could also be

argued that there would be similarities in the findings. This research can be considered as a starting point to initiate conversations about the implementation of digital technologies into Senior Geography and to formulate workable solutions to the issues raised.

The length of time the participants have been teaching Senior Geography was a strength, as their experience ranged from 3 to 14 years. There was a dominance of younger teachers and, from the literature review and the common perception, the younger generation are supposed to be more digitally literate. The reality shown in this research, however, was that there was no difference and the experiences and issues were spread across the teaching experience. Interestingly, it was the 'older' teachers who were more eager to experiment with implementing digital technologies, which contradicted the expectations in the literature review and shows that the Senior Geography teachers of all teaching experience are willing to experiment with digital technologies. It also shows that age does not automatically guarantee digital literacy and that all the Senior Geography teachers must be given equal opportunities to upskill.

Further Research

While this research has reached conclusions based on the experiences and perceptions of six Senior Geography teachers, more research is clearly needed. This is especially the case with regard to the investigation of specific examples of how digital technologies can be shown to enhance Geography as a subject and to improve teaching and learning. In addition, a discussion is needed on how the NZQA assessments can be aligned to meet the needs of Geography in the implementation of higher levels of digital technologies. It would also be useful to investigate the measures that could be taken to ensure that there is equality in accessing digital technologies for teachers and students.

There is a great deal of literature concerning the use of digital technologies to assist students and to enhance Geography, but there is little in the way of statistical evidence to show the specific benefits of incorporating digital technologies into the subject and the effects of their use on student achievement. Clearly, a balance needs to be struck between the implementation of digital technologies and the teaching of basic geographical knowledge, as this is needed to provide a foundation for the students to build upon and to use digital technologies to create new knowledge going forward. All these issues would be valuable areas for further investigation.

What is the nature of Geography? Geography is a study of the landscape, an analysis of the factors that have led to the development of the physical and human aspects of the environment. To understand the environment it is necessary to ask questions and to find answers. There are many tools that Geographers rely on in order to explore the environment and these include digital technologies. Throughout history, in their quest to discover more about the environment, Geographers have relied on the technology of the day, but they have also been instrumental in creating new technologies to

facilitate their investigations. Therefore, it is important that Geographers in the 21st century are comfortable with using digital technologies and recognise the need to implement them into their teaching programmes. There is, however, a need for caution. If they are implementing them simply because they feel that they have to, then there is a danger that the digital technologies' 'tail is wagging the Geography dog' and, as a result, this implementation will not be beneficial for Geography as a subject. Also Senior Geography teachers have to be aware that digital technologies are now a part of Geography and they should be prepared to 'dip their toe' into those that are especially designed for the subject. In considering this step, one way in for both student and Senior Geography teacher can be through fieldwork.

The aim of this study was to discover the perceptions of Senior Geography teachers regarding the use of digital technologies in their classes and to investigate how this has influenced their pedagogies. Although there is no doubt that digital technologies are being used in Senior Geography, there is still a long way to go before we can truly say that they are fully implemented. In conclusion, this research recognises the significance of implementing digital technologies within Senior Geography but it also acknowledges that this is not as easy as those outside the Senior Geography classroom may perceive. There are challenges ahead, which have to be met by a variety of different groups, and it is unrealistic to imagine that the implementation of digital technologies into Senior Geography can be left to the teachers alone.

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Glossary – Abbreviations

AGTA	Auckland Geography Teachers Association
BYOD	Bring Your Own Device
EOTC	Education outside the classroom
GIS	Geographic information system
NCEA	National Certificate of Educational Achievement
NZQA	New Zealand Qualifications Authority
PD	Professional development
Point 8's	Reference to the 'Apply spatial analysis' Geography assessments
SLT	Senior Leadership Team

Appendices

Appendix A: Alexander von Humboldt.

Friedrich Wilhelm Heinrich Alexander Von Humboldt (1769-1859), otherwise known as Alexander Von Humboldt, was a German polymath, having a wide range of expertise across many academic subjects. His interests spanned the academic subjects from the arts and, notably, the sciences. Humboldt was a geographer, naturalist, explorer, romanticist and scientist. In his lifetime he published 36 books, which included his famous book the *Cosmos* (1845), as well as 25,000 letters detailing his expeditions (Wulf, 2018).

Humboldt was an advocate of systematic geophysical measurement. As such, he insisted that only by getting out, taking detailed measurements and observing, could you truly understand what is happening in the environment. His theories and ideas about how the earth works are accepted and taught today. He was the first to propose that South America and Africa were once joined. He was the first to see the direct link between deforestation and local climate change and wrote about human induced climate change. He also located the magnetic equator and, astonishingly, managed to resurrect an extinct Amazonian language using 25 words known by two parrots and by analysing other local Amazonian dialects (Wulf, 2018).

Humboldt had many qualities, was described as charismatic, and had boundless energy. Fundamentally, however, he was curious (de Botton, 2003; Wulf, 2015). He wanted continually to acquire knowledge, and so he surrounded himself with the eminent minds of the day. Humboldt also influenced young scientists of the time, including Charles Darwin, whom Humboldt encouraged to keep collecting the data that eventually led to Darwin's *Origin of the Species*.

A contemporary of Humboldt was Karl Ritter (1779-1859). Though both were geographers, the difference was that, while Humboldt went out to collect the data, Ritter would use data from other people. Humboldt is known as one of the fathers of modern day geography.

Appendix B: Advertisements.

Senior Geography Teachers Facebook page:

Teachers of Senior Geography of two years or more: I am currently doing a MEd and my research area is looking at digital technologies and how they are used in Senior Geography. I am looking for participants who are willing to share their perceptions and experiences with regards to how digital technologies are used in the Senior Geography Classroom and the impacts on teaching and learning.

If you are interested please contact me via private message for further information.

Auckland Geography Teachers Association:

Teachers of Senior Geography of two years or more: I am currently doing a MEd and my research area is looking at digital technologies and how they are used in Senior Geography. I am looking for participants who are willing to share their perceptions and experiences with regards to how digital technologies are used in the Senior Geography Classroom and the impacts on teaching and learning.

If you are interested please contact me via email, (ahogan@mcauleyhigh.school.nz) for further information.

Appendix C: Participant Information Sheet.



Participant Information Sheet

Project title: **Digital technologies and the senior Geography classroom: Teachers' perceptions on the impact on teaching and learning.**

Project Supervisor: **Alison Smith**

Researcher: **Angela Hogan**

Date Information Sheet Produced

01/01/2020

An Invitation

Kia Ora! My name is Angela Hogan and I am a Master of Education student at AUT. This is an invitation to participate in my research. My research forms a dissertation, which is my final module towards completing this degree. I hope they will enjoy participating in the research and benefit from thinking and talking about the topic.

What is the purpose of this research?

The purpose of my research is to identify and critically examine the factors that influence how digital technologies can impact on senior Geography teaching and learning. As a senior Geography teacher myself, this area is of personal interest to me.

How was I identified and why am I being invited to participate in this research?

The reason I have contacted you is that you are a teacher of senior Geography in an Auckland secondary school and this is the particular focus of my research. I requested participants through the Senior Geography teachers' Facebook page and Auckland Geography Teachers' Association and you kindly responded. Great 😊

How do I agree to participate in this research?

If you are interested in participating in this research you can contact me using the details shown below. Your participation in this research is voluntary (it is your choice) and whether or not you choose to participate will neither advantage nor disadvantage you. You are able to withdraw from the study at any time up to 10 working days after receiving a transcript of your interview to check. If you choose to withdraw from the study, then you will be offered the choice between having any data that is identifiable as belonging to you removed or allowing it to continue to be used. However, once the findings have been produced, removal of your data may not be possible. You will be required to complete a Consent Form prior to the research being undertaken.

What will happen in this research?

As part of the research I would appreciate being allowed to interview you for approximately one hour. During this interview I will ask a series of questions about your perceptions of the use of digital technologies in senior Geography teaching and learning. We can meet at a place of your choosing, perhaps at your workplace if you have an office, or in a seminar room on one of AUT's campuses if you would prefer a venue away from your school.

What are the discomforts and risks?

There is very little risk that your participation in this research will cause you any discomfort. Most of the questions you are asked will be very easy to answer; they will simply be inquiring about your perceptions of

using digital technologies in senior Geography teaching. You may choose to disclose as much or as little personal information as you choose.

How will these discomforts and risks be alleviated?

My questions are not invasive and there is an opportunity for you to give more or less information on each question, depending on your views and insight into using digital technologies in senior Geography. You do not have to answer any question during the interview that you do not want to and you may terminate the interview at any time.

What are the benefits?

The benefit for you may be a greater understanding of the use of digital technologies in senior Geography teaching. The benefit for me is that you will be providing valuable data to me so that I can complete my dissertation. I also hope to share my research findings through presentations and a publication.

How will my privacy be protected?

The data you provide will only be seen by myself, my Supervisor and the interview transcriber. The transcriber will sign a Confidentiality Agreement that ensures the confidentiality of your interview recording and transcript. I will use pseudonyms throughout my dissertation for your name, the name of your school, and any other people or organisations to whom you may refer.

What are the costs of participating in this research?

The cost to you will be an hour of your time for the interview and another 30 minutes or so to review the transcript of your interview. You will have a week to review the transcript from the date you receive it.

What opportunity do I have to consider this invitation?

I would appreciate hearing back from you whether or not you would like to participate in the research within 5 working days.

Will I receive feedback on the results of this research?

A summary of the research findings will be made available to you once the dissertation is completed and marked, and you can also request a digital copy of the entire dissertation.

What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, Alison Smith, email alsmith@aut.ac.nz, 09 921 9999, ext. 7363.

Concerns regarding the conduct of the research should be notified to Carina Meares the Executive Secretary of AUTEK, ethics@aut.ac.nz, 09 921 9999, ext. 6038.

Whom do I contact for further information about this research?

Please keep this Information Sheet and a copy of the Consent Form for your future reference. You are also able to contact the research team as follows:

Researcher Contact Details:

Angela Hogan, email ahogan@mcauleyhigh.school.nz, 02102723003

Project Supervisor Contact Details:

Alison Smith, email alsmith@aut.ac.nz, 09 921 9999, ext. 7363.

Approved by the Auckland University of Technology Ethics Committee on 5th February 2020. Ref: 20/31

Appendix D: Consent Form



AUT

TE WĀNANGA ARONUI
O TĀMAKI MAKĀU RAU

Consent Form

Project title: Digital technologies and the senior Geography classroom: Teachers' perceptions on the impact on teaching and learning.

Project Supervisor: Alison Smith

Researcher: Angela Hogan

- I have read and understood the information provided about this research project in the Information Sheet dated 01/01/2020.
- I have had an opportunity to ask questions and to have them answered.
- I understand that notes will be taken during the interviews and that they will also be audio-taped and transcribed.
- I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without being disadvantaged in any way.
- I understand that if I withdraw from the study then I will be offered the choice between having any data that is identifiable as belonging to me removed or allowing it to continue to be used. However, once the findings have been produced, removal of my data may not be possible.
- I agree to take part in this research.
- I wish to receive a summary of the research findings (please tick one): Yes No

Participants signature:

Participants Name:

Participants Contact Details (if appropriate):

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.....
.....

Date:

Approved by the Auckland University of Technology Ethics Committee on 05/02/2020 AUTEK Reference number 20/31

Note: The Participant should retain a copy of this form.

Appendix E: Interview questions and clarification of digital technologies



Interview Questions:

1. How long have you been teaching senior geography?
2. Does your school have a BOYD policy?
3. How are digital technologies being implemented within senior geography?
4. What are your experiences of using digital technologies within the senior geography curriculum?
5. In what ways have digital technologies influenced or changed your pedagogy?
6. What is your perception of student engagement and learning when using digital technologies in senior geography?
7. How has the implementation of digital technologies in the senior geography curriculum affected you?
8. How do you see teaching geography with digital technologies in the future?

What do I mean by Digital Technologies?

Anything to do with computers or can be linked to computers which we use in geography – both inside and outside the class, with the students or just to help us teach / find resources.

Here are some examples:

- Google suite – classroom, earth, docs, forms, sites, groups,
- PowerPoints
- Using mobile phones
- Online games
- Flipped classroom approaches
- Fieldwork equipment for measuring
- Using webpages – geography revision sites
- Watching DVDs
- Interactive white boards / projectors
- Cameras (video / photo), drones Go pros
- Laptops, computers
- Photoshop
- Virtual reality / students making their own videos