Participants' views on the effects of digital technologies on their teaching/learning in food and textiles technology education.

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Abstract

Digital technology integration into general education classrooms in New Zealand is moving ahead as these technologies become more available and accessible. Literature, conferences and statutory authorities in New Zealand indicate the need to incorporate information and communication technologies (ICT or digital technologies) into educational settings in an effective way. Raising educational outcomes for further education, life-long learning, economic growth and use in industry is a top priority, especially in a subject like technology where students are challenged to problem solve, plan and create (NZ Government, 2012).

New digital applications and online environments are being developed and used in New Zealand, like POND, the Network for Learning portal which aims to “unite New Zealand teachers, school administrators and students with providers of educational content and services” (Network 4 Learning, 2014), with the view of “strengthening the capability of teachers and school leaders to integrate the use of digital technologies with effective teaching and leadership practices” (NZ Government, 2014, p.18). Specific subject courses like food or textiles technology have little research in the area of digital technologies on which to base development and implementation.

Technology courses are a mixture of practical skills based activities along with a design process which incorporates technological literacy and theory. Using digital technologies effectively in a blended learning environment would be beneficial for students to manage this complex learning. The main research question of this study is: How is the pedagogy of food and textiles technology teachers changing with the introduction of digital technologies? This was asked to find out what the teachers’ digital pedagogies are and also to determine how they perceive the use of blended learning to assist students with digital preparation for future employment and study in the wider community.

The interpretive methodology using an initial questionnaire to gain some quantitative data followed by semi-structured interviews to gain greater

insight in a qualitative manner were used. The perceptions of the pedagogical approaches teachers were using was also partially gained from the questionnaire. This was initially analysed with the use of the SAMR and also the TPACK models thus assisting with the discussion on the pedagogical integration of digital technologies in food and textile technology classrooms.

A thematic approach was used to analyse data collected and the findings include the positive use of digital technologies in the participants' food and textile technology classrooms. The Teaching as Inquiry model proved to be a useful tool to assist teachers. Some thoughtful integration of digital technologies, in their particular subject contexts, was demonstrated. The participant teachers showed a desire to use many of the available online educational resources and have found their students are using these tools effectively and often in a creative manner. The teachers used various digital technologies for instance Youtube videos to show students techniques to assist them with product design or development. They also utilised different assessment collection methods such as videoing conversations which can give greater flexibility to the teaching and learning. It is an exciting time in technology education for both teachers and students alike.

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Kia kaha. Kia hora te taurikura ki runga i ō whānau.

(Stay strong. Let prosperity be spread over your families).

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Chapter 1: INTRODUCTION

1.1. Background to the study

The requirements of food and textiles technology education are changing as we progress further into the 21st century. Over the years New Zealand technology teachers have been consistently updating and changing their programmes to better equip students for the times in which they live. Research into the use of digital technologies (DTs) and information and communication technologies (ICTs) for education is becoming more commonplace in today's world as students gain greater access to more and more powerful technologies. What began as a separate technological area in technology education, information and communication technology (ICT) is now called digital technology (DT). Digital technologies have become more commonplace in every subject area in New Zealand classrooms and when used in educational settings are often referred to as eLearning (electronic learning). Students are beginning to have access to their own devices (BYOD Bring Your Own Device or 1:1 devices) along with greater availability of technology hardware and software access within New Zealand school environments (Johnson, Maguire, & Wood, 2017).

As early as 1987 the *Review of Recent Research Literature on Computer-Based Instruction* and its effectiveness by Kulik and Kulik concluded that "most programs of computer-based instruction have had positive effects on student learning" (p. 229) and should continue to do so if they are designed well. More current research shows a variation in findings with differences in effectiveness and results occurring "even where computers are used in the classroom, their impact on student performance is mixed at best" (Organisation for Economic Co-operation Development, 2015, p. 3). Such is the importance of digital technology in education that all learners from years one to thirteen will see the subject fully integrated into the New Zealand Curriculum (NZC) and Te Marautanga o Aotearoa (education.govt.nz, 2016).

Studies in food and textiles technology (FTT) education which combine the use of eLearning with subject content have indicated that there are

barriers and affordances with blended learning as it can have an effect on the uptake of digital technologies (Ho & Albion, 2010; Jenkins, 2008; Johnson, Hedditch, & Yin, 2011; Lau & Albion, 2010; Mangan, Forret, & Buntting, 2012). Food and textiles technology is an area of education that has its own unique requirements of students in both complex practical skills-based learning and theory based technology design process components within the same classroom. It involves “not just the social context, but also the physical context, with thinking being associated with and structured by the objects and tools of action” (Jones, 2005, p. 8). The subject can also sit between the two New Zealand curriculum areas of food and textiles technology in the technology curriculum area and home economics in the health and physical education curriculum area. In addition some teachers also teach it in the vocationally focused hospitality subject area at senior levels.

1.2. Research questions and supporting questions

The effective integration of digital technologies into New Zealand schools in many of the core subject areas taught has been considered in research, however there is little teaching and learning information available in senior secondary technology education research (Joyce & Hipkins, 2015) and in particular food and textiles technology or home economics. Therefore with the current focus on 21st century learning, modern learning practices (MLP) and future focused learning, the main research question guiding this research is: How is the pedagogy of food and textiles technology teachers changing with the introduction of digital technologies?

And supporting questions include:

- What are seen as the most useful digital technology tools by food and textile teachers for modern learning practices?
- What are the approaches to the incorporation of eLearning into New Zealand classrooms and to what extent are they being used in food and textile technology classrooms?
- What are the food and textile teachers’ perceptions of current and future eLearning needs of their students?

Hopefully these questions may contribute to filling a gap in New Zealand's educational digital technology research, particularly in subjects where there is a skill based or practical component and also be a useful resource for teachers.

1.3. Researcher's background to the study

New Zealand food and textile technology classrooms have seen many changes over the past thirty years. I have been immersed in this evolution during the past seventeen years teaching and previously when training as a home economics and technology teacher. Questioning, working with, reflecting on and evaluating these changes has become part of my teaching norm. The most noticeable shift in technology usage has been the tension between barring device use in classrooms due to personal distractions or allowing more use for their benefits to learning, to the possibility now of fully integrated digital technology into our classrooms (Luckin, Bligh, Manches, Ainsworth, Crook, & Noss, 2012; Selwyn & Bulfin, 2016). At this point, my impressions are that many teachers have shown thoughtful consideration when adapting to changes but the introduction of digital technologies has raised even more and varied questions.

Today, as a classroom teacher, I have the wonderful opportunity to teach not only in food, hospitality and textiles technologies, but also junior secondary classes (Years nine and ten) in digital technology, design and visual communications, visual arts and English. I am fortunate enough to be trained in all these subject areas and have a desire to look at how eLearning is evolving in teaching and learning along with how it can guide students towards life-long learning in these interesting subjects. Also the opportunity to gain knowledge from teaching colleagues and to assist them provided strong motivation for this thesis.

1.4. Thesis organisation

Chapter 1 - Introduction

Food and textiles technology education has a long background in New Zealand education. This study will look at teachers' integration of digital

technologies into these important learning areas. The introduction includes a background to the study, the guiding questions for the research and the researcher's background details which provided motivation for this study.

Chapter 2 – Literature Review

The main focus of the literature review will be on the inclusion of digital technologies into FTT and other related subject areas. The terminology and backgrounds that can guide the incorporation of eLearning, barriers and affordances to this and models that can be used to guide or show the effectiveness of this integration. A discussion on modern learning practices and future focused learning will conclude this chapter.

Chapter 3 – Research process and methodology

This chapter looks at the multi-method methodology of data gathering using a survey questionnaire followed by interviews to gain more qualitative data. There is a discussion of the techniques that have been employed as an attempt to answer the research question and their effectiveness.

Chapter 4 – Results and summary

The results of the survey and interviews are presented as themes that have emerged in the data. These outcomes are explored further in this chapter.

Chapter 5 – Discussion

The aim of the discussion is to answer the research questions and sub-questions using the findings from literature and the data.

Chapter 6 - Conclusion

This chapter concludes the research study with reference to the literature review and the previous chapter's discussion.

1.5 Terminology

Information and communication technology – Livingstone (2012), discusses the diverse forms of ICT and how it can be perceived as an umbrella term in educational literature. It has been used to "include one to

many technologies (usually used by the teacher at the front of the classroom) and peer-to-peer technologies, professionally produced and user generated contents". Livingstone continues to explain that it can also include "technologies specific to the school (e.g. interactive whiteboards) or those used across formal/informal boundaries (e.g. edugames)". She concludes that it also can include "both stand alone and online, networked technologies" so discussing effectiveness with ICT use in educational situations can be problematic as the term is so broadly applied (p. 13).

Digital Application – This is defined as,

> "A broad term refers to any application software that can be used by a computer, mobile device, or tablet to perform useful tasks. A specific piece of such software is called a software application, application program, application or app. A **digital** application is different from system software that manages, integrates a computer's capabilities that serves the application" (IGI Global., 2017).

Digital technologies – Hangarau matihiko – as defined in the New Zealand Education Review Office, "Modern New Zealand Learning Practice: glossary", digital is defined as;

> Anything using a binary code (Code with two values). Digital is used to refer to things which, at the very basic level, use the binary code. E.g. a digital device could be a computer, phone etc. If a course 'goes digital' then it is using the online tools to organise the course material, often making access and collaboration for students and teachers easier. (Education Review Office, 2016, p. 17)

Adding technology to this it becomes, 'digital technologies' which is defined here as "all the technology that relies on the binary code to represent words and numbers." (Education Review Office, 2016, p. 19).

In the same document above is a clear definition of eLearning,

> E-Learning (Electronic Learning) is learning that is facilitated and supported through the use of digital technologies. It covers a

spectrum of activities from supported learning, face-to -face teaching in conjunction with e-learning, known as blended learning, to learning entirely online. It can be self paced and can occur in or out of the classroom or at home. (Education Review Office, 2016, p. 20).

Chapter 2: LITERATURE REVIEW

2.1. Introduction

This chapter will look briefly at the changes in technology education in the fields of food and textiles education along with the integration of digital technologies in an educational context. Blended learning is explored due to the introduction of eLearning into once traditional classrooms where pen and paper were used to take notes and textbooks or worksheets were the norm.

Education today looks very different from what was experienced in the past. We live in a time-poor pressurized society with processed, pre-packaged, ready-made food and clothing. The ways students learn today need to both reflect and counter this. Teachers and learners have access to more powerful learning tools than ever before and using them effectively seems paramount. Yet Williams, Jones, and Buntting (2015) titled the first chapter of their book: *The Future of Technology Education, The more things change the more (some) things stay the same* in which they describe the "complex, dynamic nature of teaching and learning in the technology education classroom" (pp. 1-3). In the book's concluding chapter, de Vries (2015) suggests design-based studies should become more prominent especially where they have research questions which, he argues, "relate more directly to what interests and is valued by the teachers, particularly the effect of new and innovative learning materials" (Williams et al., 2015, p. 267), and those very same teachers should lead the researchers.

Food technology, textiles technology and home economics education in New Zealand is an area where there is a need for further investigation. Computer based digital learning has been researched in many learning areas yet the best use of digital technologies in food technology, textiles technology and home economics education is lagging behind. The aim of this literature review is to find what has been discovered in the most current educational research at secondary school level and relate it to the pedagogical use of digital technologies in these specialist classrooms.

2.1.1. Food technology, textiles technology and home economics education

Home economics (or home and life sciences) was incorporated into the health and physical education (HPE) curriculum. The food and textiles technology areas were being developed for the new technology curriculum area drafted in the years prior to 1999, when this new curriculum document for New Zealand came into effect (Street, 2006). Many of these teachers could now be teaching in two sometimes three different curriculum learning areas. The 1877 *Education Act,* which, as described by Harwood & Compton, (2007) *"*outlined a framework for national schooling for all New Zealand children, and provide a foundational framework to enable technical education to be implemented" (pp. 105-106) with manual and technical instruction divided between primary and secondary schools.

Home economics taught life skills, predominantly to women and girls, in an attempt to legitimise household work and also as a response to the social issues of the period (Street, 2006). These are still relevant concerns today with the added Hauora focus (the Maori philosophy of well-being which includes physical, mental and emotional, social and spiritual wellbeing) woven into this curriculum area where both female and male students benefit from learning in the health and physical education area. As stated earlier, New Zealand secondary school teachers of home economics have often become food and textiles technology teachers and hospitality subject teachers.

Home economics and technology education are within the National Certificate of Educational Achievement (NCEA) framework of assessment and are university approved subjects. Traditionally, hospitality has been a unit standards course with a link to the hospitality standards institute and the food and beverage industries training organisation currently called Service IQ. In both the home economics areas and predominantly the food and textiles areas of the technology curriculum a combination of achievement and unit standard assessment outcomes have been offered

by schools, which is similar to other contexts in the Technology education area (Bowskill, 2012).

Harwood and Compton (2007), questioned in a paper they presented to the Technology Education in New Zealand teachers association (TENZ) conference, why the change from technicraft to technology was and continues to be a difficult transition. They see the development of strong professional development programmes along with the continued valuable role of technology teachers communicated strongly to the community as integral to the development of the subject area. Granshaw (2015) also concluded that the importance of effective resource development to assist with technological literacy along with professional development continues to be important components for building on the success and implementation of the technology curriculum and senior assessment structure.

Information and communications technology was a subject taught in New Zealand schools when the 1995 technology curriculum was implemented. Students were taught how to word process and utilise programmes such as Excel for numerical functions and Powerpoint for presentations. It became common to use this term generally for all computer based learning functions, including hardware and software. Savidan (2003) referred to the following definition of ICT from this curriculum as "… artefacts, systems and environment that enable the collection, structuring, manipulation, retrieval and communication of information in various forms" (New Zealand Ministry of Education, 1993, p. 12) and she concluded "apart from isolated cases, ICT has not yet been incorporated into the New Zealand secondary school curriculum" (Savidan, 2003, p. 139).

Digital technology is a broader term used than ICT. With the invention of new technologies for instance, 3D printers and other computer numerical controlled (CNC) devices, along with computer simulation and virtual and augmented reality (for example, the transient game craze Pokemon Go. This game used the global positioning system (GPS) co-ordinates of an actual place then would overlay a Pokemon image that could be caught and saved on a device). Digital technologies can also be considered more

than an information or communication technology. They can be external to a digital device or computer, such as cloud based, so it is becoming more important to have the terminology defined for the specific purposes of the ICT or digital technology that is being described. Digital technologies, including devices and machinery, continue to develop at an increasingly fast rate presenting new challenges for schools and society.

2.1.2. Computer based learning and its effectiveness

The effectiveness of the use of ICT and digital technologies for eLearning and eTeaching is an ongoing discussion with much being written about it. The Organisation for Economic Co-operation Development (OECD, 2015) report: *Students, Computers and Learning: Making the Connection* states that “the connections among students, computers and learning are neither simple nor hard-wired; and the real contributions ICT can make to teaching and learning have yet to be fully realised and exploited” (p. 15). Equity of education, amongst the 70 countries who contribute to this research, would need to be equal in terms of what is described as “a baseline level of proficiency in reading and mathematics” (p. 16). The report also states the following:

> PISA results suggest that limited use of computers at school may be better than not using computers at all, using them more intensively than the current OECD average tends to be associated with significantly poorer student performance. ICT is linked to better student performance only in certain contexts, such as when computer software and internet connections help to increase study time and practice. (p. 16)

New Zealand is one of the seventy countries involved in the OECD and therefore this report carries some significance here. The Ministry of Education in New Zealand have also commissioned several reports to gain data and information for the introduction of digital technologies into New Zealand schools and the unique National Certificate of Educational Achievement (NCEA) assessment system for senior, year 11-13 students. The most recent reports include the following: The 2014 report by the

20/20 Communications Trust titled, *Digital Technologies in NZ schools* (Johnson, Wood, & Sutton, 2014); *Supporting future orientated learning and teaching – a New Zealand perspective* (Bolstad, Gilbert, McDowall, Bull, Boyd, & Hipkins, 2012) and *eLearning and Implications for New Zealand schools: a literature review* (Wright, 2010), and along with others that have helped to inform digital technology integration within learning environments.

The availability of online resources for teachers is increasing. The New Zealand Ministry of Education has developed what is described as an "enabling eLearning" website with information for teachers and educators (New Zealand Ministry of Education, n.d). Teachers have been well supported with the introduction and continued use of digital teaching techniques which have been researched and considered in different learning contexts. Positive evidence found from quantitative and other "empirically sound studies" (para. 1) have been documented in different learning areas including classrooms where eLearning has been integrated into technology classrooms. Some of the studies found on this website were those that described this integration of ICT with pedagogy and its impact on learning included: Balanskat, Blamire, & Kefala, 2006; Moran, Ferdig, Pearson, Wardrop, & Blomeyer Jr, 2008; Shapley, Sheehan, Maloney, & Caranikas-Walker, 2011; Sheehan & Nillas, 2010; and Somekh, Underwood, Convery, Dillon, Jarvis, Lewin, Mavers, Saxon, Sing, Steadman, Twinning, 2007.

According to Mumtaz (2000) research findings in the previous "20 years provide some evidence as to the positive effects of the use of information and communications technology (ICT) on pupils' learning" (p. 319). Other findings, around this time, considered the change from the industrial to information societies. Pelgrum (2001) expressed the following concerns:

> The information metaphor has triggered off a whole set of wild speculations about the necessity of educational reforms that will allow future citizens to survive in an information society. Expectations that were mentioned in several influential policy documents are shown in Table 1, reflecting a shift from the learner as passive

consumer of educational offerings to an active knowledge gathering and productive participant in educational activities. It seems that the current belief is that ICT is not only the backbone of the Information Society, but also an important catalyst and tool for inducing educational reforms that change our students into productive knowledge workers. (p. 163).

Table 1.

Possible changes for education from the industrial to the information society.

Table 1
Expected changes from education in the industrial society to education in the information

Actor	Education in the Industrial Society	Education in the Information Society
School	• Isolated from society • Most information on school functioning confidential	• Integrated in society • Information openly available
Teacher	• Initiator of instruction • Whole class teaching • Evaluates student • Places low emphasis on communication skills	• Helps students find appropriate instructional path • Guides students' independent learning • Helps student to evaluate own progress • Places high emphasis on communication skills
Student	• Mostly passive • Learns mostly at school • Hardly any teamwork • Takes questions from books or teachers • Learns answers to questions • Low interest in learning	• More active • Learns at school and outside school • Much teamwork • Asks questions • Finds answers to questions • High interest
Parent	• Hardly actively involved in learning process • No steering of instruction • No life-long learning model	• Very active in learning process • Co-steering • Parents provide model

Source: Pelgrum, ten Brummelhuis, Collis, Plomp, Janssen Reinen (1997).

Note. (From "Obstacles to the integration of ICT in education: results from a worldwide educational assessment," by W.J. Pelgrum, 2001. *Computers & Education, 37*(2), p. 164).

Pelgrum also conducted a worldwide survey to ascertain what obstacles may be in the way of integrating ICT in the lower secondary education in 26 different countries and looked also at current pedagogical practice using ICT in education. He posited the need for ICT in education to be linked to pedagogical practices and not what he described as the "uni-directional transfer of information: from teacher to the student" (traditional teaching methods) as it has been in the past (p. 165). This could help ensure that the students would become lifelong learners and be prepared

for the Information Society to come. He argued that assistance could come from using and exploring different pedagogical models linked to technology integration. This could include a combination of ICT and traditional learning (called ‘blended learning’), through to a more digital education landscape which would offer greater independent learning and that could be provided entirely online. This could mean that the students would need to become more independent in their learning. Pelgrum stated clearly, however that, “there is no recipe for education of the future, one may wonder to what extent schools already embrace the notion of more autonomous learning of students” (2001, p. 165).

More recently, Devlin, Feldhaus, and Bentrem (2013), found “substantial evidence that incorporating technology, of any kind, in the classroom as an instructional tool enhances student learning and educational outcomes” (p. 36). This may be true for the millennial generation (born between 1980 and 2000 and sometimes referred to as “Generation Y”) who were the focus of his study and have generally had ready access to technology. This gives them a greater chance of effectively using the technology that is available to them. Devlin et al., also believes that if “student engagement is the key to academic motivation, persistence, and degree completion” then he argues, “engaged students are more likely to become technologically literate and competent” (p. 37). As yet, there does not seem to be conclusive proof that the use of digital technologies improves student learning outcomes. However, according to Higgins (2003) research has shown that ICT can make a difference and this is backed up in his 2012 study where he reports that “the impact of digital technologies on learning consistently identifies positive benefits” (Higgins, Xiao, & Katsipataki, 2012, p. 3).

Overall views and research outcomes are mixed when it comes to whether or not digital technology is the educational ‘bullet’! According to the New Zealand Ministry of Education, (n.d, para.1) much of the evidence that is qualitative tends to be small case study research projects within individual classrooms using one digital tool. Also, as argued in the report from the Organisation for Economic Co-operation and Development, (2016)

“despite the huge potential of digitalisation for fostering and enhancing learning, the impact of digital technologies on education itself has been shallow” (p. 3). Higgins, et al, 2012, found that the technology needs to be linked to what is being learnt so, it is “the pedagogy of the application of technology in the classroom which is important: the *how* rather than the *what”* (p. 3). Digital technology should not replace traditional learning but is a tool best used to supplement what is being learnt for attainment. This attainment has been generally found in mathematics and science when compared to literacy, so other subject areas need to ascertain what will make digital technology use more successful (p. 4).

Subject areas like English, languages, mathematics and science programmes can purchase dedicated educational programmes, for example Education Perfect, which are now starting to be used more widely in New Zealand schools. It can be a very important component of teaching and learning especially when used alongside other successful teaching methods which also allows for independent learning to occur. The integration of digital technologies into the technological subject areas needs to be developed further so that the pedagogy of the learning area is at the forefront. If eLearning is included just because it is a government initiative then this does not always add value to the students’ learning experience (Watson, 2001). The pedagogy, behind the ‘electric learning’ as one New Zealand senior technology student named it, must be relevant as teachers transform their practice to be more collaborative and use digital innovations effectively (Parsons, Thomas, Inkila, Antipas, Valintine, Pham, & Vo. 2015).

2.1.3. Blended learning and integration of digital technologies in education

Parkes, Zaka, & Davis, (2011) found that there are “particular challenges and opportunities for blended learning” (p. 3). This can be especially true with the integration of digital technologies into practical subject areas like food and textiles technology which involves the use of eLearning in both practical and theory work. The definition of eLearning according to Anderson, Brown, Murray, Simpson, and Mentis (2006) “remains fluid as it

has changed from one iteration of policy to the next" and New Zealand does not have a set or agreed definition for eLearning and other digital technology education terminology. Shepard (2013) uses a very broad definition of eLearning ('electronic' learning) which is "when we use computers and the networks to which these are linked to in some way support the learning process" (as cited in Hubbard, 2013, p. 3). Shepard continues to explain, during a seminar in 1999, how the term originated. Previously computer based learning was delivered on a CD ROM not over a network, so a term needed to be coined for the new type of delivery. Today there are many forms or ways we use eLearning along with traditional methods of teaching. The table below, compiled by Allen and Seaman (2013), gives a typical definition of the terminology used for course instruction. It also reports on tracking online delivered education in the United States over the past ten years with the different course deliveries.

Table 2.

Different methods of course delivery.

Proportion of Content Delivered Online	*Type of Course*	*Typical Description*
0%	Traditional	Course where no online technology used — content is delivered in writing or orally.
1 to 29%	Web Facilitated	Course that uses web-based technology to facilitate what is essentially a face-to-face course. May use a course management system (CMS) or web pages to post the syllabus and assignments.
30 to 79%	Blended/Hybrid	Course that blends online and face-to-face delivery. Substantial proportion of the content is delivered online, typically uses online discussions, and typically has a reduced number of face-to-face meetings.
80+%	Online	A course where most or all of the content is delivered online. Typically have no face-to-face meetings.

Note. (From: "*Changing Course: Ten Years of Tracking Online Education in the United States*, (p. 7), by I.E. Allen & J. Seaman, 2013. ERIC).

Consistent terminology is important when considering how web based resources are being used in classrooms alongside different subject areas. Adding to this terminology list, the 21st Century Learning Reference Groups (2014) report on Digital Technologies in New Zealand Schools report discusses future-focused technologies such as “3D printing and interactive video” and future-focused learning applications which include “TED talks, online assessments, gamification and Khan Academy” (O’Riley, Amos, Copeland, Fidow, Langford, Newton, Ohia, Shevland, Sutherland, & Sylvester, 2014. p. 6). As new technologies and integration of technologies in education emerge, the terminology to describe these grows.

Blended learning is a common term used in education to describe the use of digital technologies alongside older and more traditional methods of instruction. Bonk and Graham (2012) found the three most commonly mentioned definitions, documented by Graham, Allen and Ure (2003), are: “Combining instructional modalities (or delivery media) (Bersin & Associates, 2003; Orey, 2002a, 2002b; Singh & Reed, 2001; Thomson, 2002); Combining instructional methods (Driscoll, 2002; House, 2002; Rossett, 2002); Combining online and face-to-face instruction (Reay, 2001; Rooney, 2003; Sands; Ward & LaBranche, 2003; Young, 2002)” (as cited in Bonk & Graham, p. 65). Blended learning can also be structured or unstructured with more or less monitoring from the teacher and greater or lesser active involvement between students (Kumi-Yeboah, 2013, p. 27).

The blended learning approaches identified by Driscoll in 1998 and documented in Jordan, Carlile, and Stack (2008), *Approaches to Learning: A Guide for Teachers* book describe them as:

Self Regulated Approach	Learners interact autonomously with a range of technologies such as web-based audio or video clips, simulations and virtual learning environments to achieve a particular learning outcome.

Pedagogical Approach	The teacher selects suitable pedagogical approaches, which may or may not involve instructional technology, in order to achieve a particular learning outcome.
Mixed approach	Face to face delivery is combined with any type of instructional technology in a flexible way.
Learning outcome-based	The learning outcomes determine the forms of *approach* delivery, and the technology and methodology are carefully aligned with them. (as cited in Jordan et al., p. 228).

A combination of these methods can be found in the teaching of food and textile technologies. With both structured and unstructured learning and the practical nature of the subject, the students need to learn how to co-operate. Advantages of blended learning can include a wider audience, student knowledge construction, collaboration between peers, teachers and experts, an audio-visual environment, interactivity where, as described by Jordan et al. (2008), students “are motivated to direct their own learning” and reflections (pp. 228-229).

Baglien (2009) discusses, in her qualitative study which focused on the use of blended instruction as a method for teaching family and consumer sciences (FCS) education, how “blended instruction uses the best features of face-to-face instruction to create a rich learning environment” (p. viii). She also describes how the “constructivist view, or the belief that learning should be more student centred rather than instructor provided, fits the use of blended learning” (p. 3) and investigates further what might influence the structure that blended learning might take in a FCS education context.

The extreme use of digital technologies where no other educational tools are used is known as a paperless classroom. Teaching can also occur outside the classroom (EOTC) or be set as homework which, when digital, can be termed as flipping the classroom. Students are often being directed towards individual programmes as digital integration becomes more

advanced and technology becomes more accessible thus allowing students greater opportunities for inquiry based learning, where students have greater input into their own learning (see Figure 8). Currently, there are few dedicated eLearning resources along with subject specific information for food and textiles classrooms in New Zealand. Teachers have found the need to develop their own to include digital technologies into their programmes of work. Those educators who do more to include "digital technologies as teaching tools" find that the increase in workload and changes can be overwhelming (Bright in Wright & Forbes, 2015, p. 161).

There are, however, multiple online sites available for educators to access information for the integration of digital technologies. These sites provide information on the different types of eLearning tools available, blogs that illustrate the use of tools and how they have been effective. Along with those are sponsored sites by the companies that produce the tool or facility, for example; Google drive, Google classroom and the increasing Google suite of applications. Subject specific teachers may need to learn how to access these tools and sites, find out how they work and select and adapt what is suitable for their students. This can be time consuming and frustrating if there is no immediate access to assistance and if, as suggested by Johnson et al. (2011) the "student resources appear to have low levels of usage" (p. 4). On the positive side of blended learning, Parkes et al. (2011) discussed the "opportunities for extended and flexible learning, development of ICT confidence and skills, enhanced interactions; independent learning with increased self management and higher order thinking skills; a variety of authentic resources; and the teacher's professional growth" (p. 1) can outweigh the difficulties of integration.

2.1.4. Theories of student learning using digital technologies

Marzano (1992) stated that there has been an "explosion of knowledge about learning" (pp. 1-2) since the advent of cognitive psychology in the 1960s where "psychologists began to study the underlying processes of learning". Marzano, believed that previously there was little known about

the learning process as behaviourism (which was often assessed by the recalling of low-level information (p. x), had dominated psychology for over forty years. He stated that “effective teaching mirrors effective learning (where) effective learning requires a more in-depth analysis of the new information to organize and shape it in ways that highlight what’s important and to weed out errors” (p. 9).

Research findings by Pitler, Hubbell, and Kuhn (2012) “shows that integrating technology into instruction tends to move classrooms from teacher-dominated to student-centred learning environments” (p. 3). Further to that, inquiry learning is changing the way effective teaching and learning can look. Lee (2011) discusses how “inquiry-guided learning promotes the acquisition of new knowledge, abilities, and attitudes through the investigation of questions, problems, and issues using the ways and standards of inquiry in the disciplines” (p. 151).

Bolstad et al. (2012) when looking at the different forms of student inquiry and integrated-inquiry approaches to 21st century learning, discussed possible requirements enabling students to “be able to *do things* with knowledge” with a curriculum that provides active problem-solving and discovery type learning experiences (p. 4). It was also suggested that “people do not learn well if they are seen as ‘spectators’ who are passive recipients of small bits of pre-packaged knowledge” (p.14) similar to when students are taught using traditional “chalk and talk” methods. What is seen to be needed are individuals immersed in their own education and learning so they are capable of learning more, the more that they learn.

Along with this the findings of Barron and Darling-Hammond (2008) show that where students are able to use “authentic learning” they learn with greater depth and are better able to perform complex tasks (p. 3). The following diagram expands on this idea of authentic learning, initially attributed to Edgar Dale (1969) and called a Cone of Learning. It shows an outline of learning activities and outcomes and what students remember after two weeks.

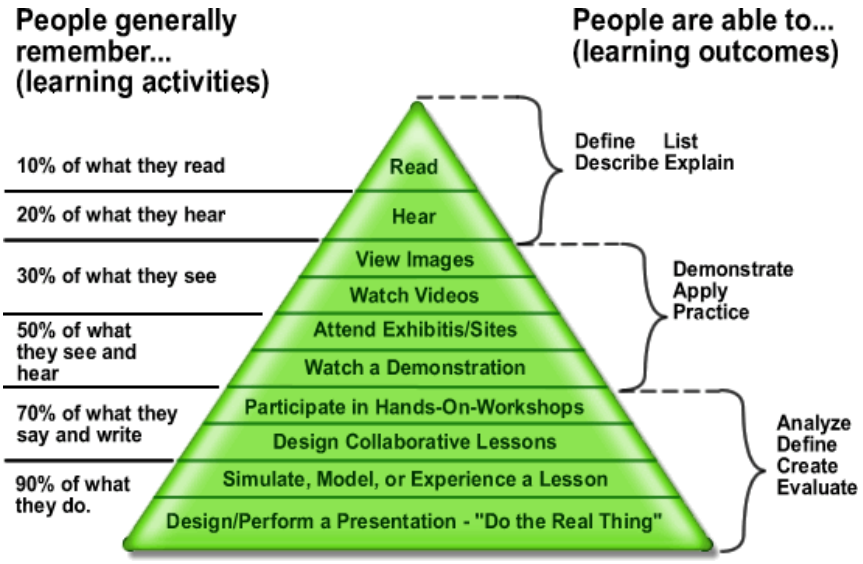

Figure 1: Adapted Cone of Learning initially developed by Edgar Dale. From *Oakland Schools Literacy,* by Oakland Schools, 2017. Retrieved from: http://www.oaklandschoolsliteracy.org/resources/technology/

This Cone of Learning diagram is used and developed further by "Percepsys SIMSTUDIO™" who use "a unique mix of technological innovations and instructional methodologies that brings the power of full 3D simulation training to the web." (Percepsys, 2017b). In their product presentation they explain "Scenario-based learning is similar to the experiential model of learning. Learning seldom takes place by rote. Learning occurs because we immerse ourselves in a situation in which we're forced to perform". (Percepsys, 2017a). When a learner is involved in what they are doing there is a tendency to remember "90% of what we say and do" according to the Percepsys version of the Edgar Dale's Cone of Learning shown in Figure 2 below:

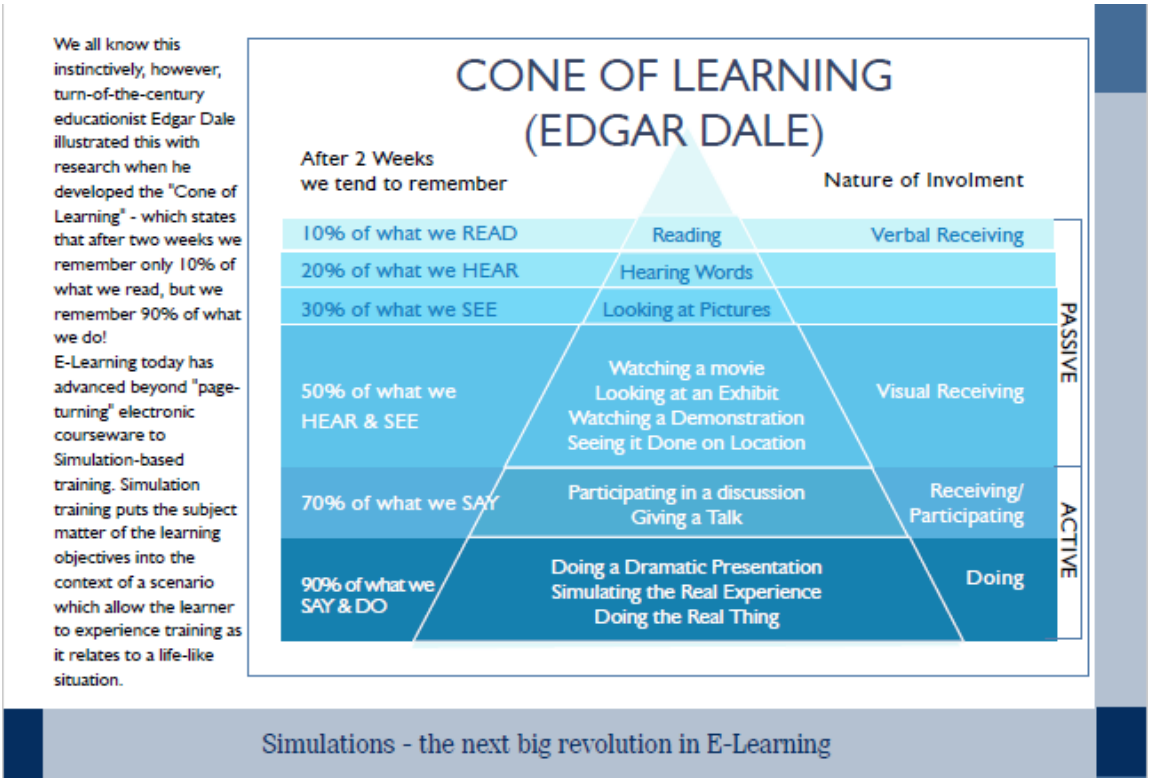

Figure 2. Adapted Cone of Learning (Edgar Dale) slide. From *Percepsys,* 2017. Retrieved from: http://www.percepsys.com/simstudio.htm).

The term that can best be used to describe this new type of learning using digital technologies is Modern Learning Practice (MLP). According to the New Zealand Education Review Office (2016) MLP "incorporates responsive teaching practice, student ownership of learning, high levels of engagement, authentic contexts, the development of competencies and the strategic use of digital technologies to connect, collaborate, create and share learning" (p. 38) some of which is indicated on the wide base of the learning cone (see Figures 1 and 2).

The OECD Centre for Educational Research and Innovation (CERI) who analyse learning and innovation in education, published the *The Nature of Learning Using Research to Inspire Practice*, (Dumont, Istance, & Benavides, 2010). Here research is analysed in educational areas as "global drivers … pushing all countries to give priority to generating high levels of knowledge and skills with attention increasingly to more demanding forms of "21st century competencies" (p. 3). Their international

studies are impressive and their findings used worldwide. An important finding from their studies was that *"*Learning is Collaborative and also that learning is cumulative and individually different" (p. 52).

In the same volume, Schneider & Stern (2010), from the Zurich Institute for Behavioural Research, discuss the prior understanding of knowledge being more about the quantity of knowledge and facts being gained. They argue that it is increasingly more about "the *quality* of knowledge". This stems from students becoming increasingly expert at solving both every day and complex problems using evolving complex learning processes and the need to be able to apply knowledge gained in order "to solve (new and) relevant real-life problems" (as cited in Dumont et al., p. 71). Their conclusion to the ten cornerstone findings in knowledge acquisition seems to be summed up with "good learning environments foster transfer between content domains as well as between the learning situation and everyday life" (as cited in Dumont et al., p. 85). These are all important aspects that can be reflected in the food and textile technology classrooms.

Along with a good learning environment, Harwood and Compton (2007) also found student centred, constructivist pedagogy rather than a behaviourist learning theory approach by the classroom teacher allows for active participation in the evolution of learning. They acknowledged that along with the active participation of the student, "constructivism also encourages teachers to develop learning outcomes prior to the learning experience, to ensure that students can develop knowledge and skill that are in keeping with those that are deemed to be "correct" (p. 109).

Garrison (2011), goes on further to explain that:

> The teaching and learning transaction is a coherent representation and translation of the dynamics of a collaborative and constructive educational experience. The recognition of these two interests is crucial in constructing a theoretical framework through which we can understand and apply e-learning for educational purposes. (p. 10).

A further point is the intertwining of the “personal” and “social” worlds where “meaning is constructed and shared” and which was first espoused by the work of John Dewey in the early 20th century. Garrison (2011) found that “technological innovation can dazzle but does not directly reveal educationally worthwhile outcomes. Educators are moving beyond the myth and hype of technology and are trying to figure out where we need to go educationally in a creative knowledge society” and argues that we have “reached the threshold of a new era” (p. 132).

We learn from Jonassen (2013), referring to today’s post-modern youth, that he has faith in “educators who seek to transform education, to reorganise its foundational goals and values, can emancipate learners, … to empower them to reflect on and represent what is important to them” (as cited in Olson, Clough, & Niederhauser, p. 109). He, like Garrison (2011), may help see us in to “a new era that will see the convergence of pedagogical ideals and technological possibilities” (p. 132) which can “help to transform learners and learning-to help them become independent, self-regulated, lifelong seekers and constructors of knowledge” (Jonassen as cited in Olson, Clough, & Niederhauser, 2013, p.109).

Other theories of learning including cognitive theories, constructivism, as explained above, and the opportunity to include digital content where blogs and wikis can be created and online tools used alongside social media platforms and networking is being used by students (Baker, 2010, p. 15). This was also a feature of the distributed cognition theory (Brown, Collins, & Duguid, 1989) containing a social learning component which is suited to some online learning features. Along with this we may find subjects like food and textiles technology education with practical skills based learning, will need companies like Percepsys, where computer based “simulation training puts the subject matter of the learning objectives into the context of a scenario which allow the learner to experience training as it relates to a life-like situation.” (2017a). This type of authentic action research learning, where people are learning from their

own experiences, in conditions they have organised themselves and sharing it with others (McTaggart, 1997), may be what the educational future holds.

2.1.5. Global and local 21st Century or future focused teaching and learning

Bolstad et al. (2012) discuss the widely used term "21st century learning" and the appropriateness of its use now we are in the second decade. It would have been appropriate to use 21st century research for the development of the current 2007 New Zealand curriculum document where the vision was for "lifelong learners who are confident and creative, connected and actively involved" (p. 4). This was important so that students are "equipped with the knowledge, competencies, and values they will need to be successful citizens in the twenty-first century" (p. 4). There has been a move to "future orientated learning" for innovative teaching techniques that was described as "an emerging cluster of new ideas, beliefs, knowledge, theories and practices" (p. 1).

Ferguson (2009) in his paper for the Ministry of Education titled *Technology education in New Zealand Schools 1985-2008* discussed how technology education became part of the NZ curriculum. The 1993 draft curriculum was the precursor to the 1995 Technology Curriculum Statement and in 1999 the curriculum was implemented. After a stocktake of the technology curriculum area "The New Zealand Curriculum Draft was distributed to schools in 2006" (p. 6) and then after a period of revision the full implementation of the new curriculum in 2007. This curriculum is still in place today, with teachers and schools having had support during its implementation, (p. 41) and currently the continued development due to the implementation of the new digital technology programme in New Zealand primary and secondary schools (Ministry of Education, 2016).

Ubiquitous learning (or uLearning) is connected to lifelong learning where learning can occur throughout our lives, almost anywhere, anytime. The ability to connect to a digital learning environment or access information through the internet to support learning in any context or situation has

arrived. Ogata (2011) discussed how it can be individual or collaborative learning and increasingly at almost any age or skill level. Bolstad et al. (2012) discussed how “we need to rethink our ideas about how our learning systems are organised, resourced and supported” (p. 2) as we bring about greater innovation with modern teaching and learning practices.

The views of the future of technology in education are varied due to the ubiquitous nature of technologies, whether we use a mobile device like a cellphone or smartphone, or one of the increasingly smaller and more powerful laptop computers. We are becoming more connected to the global village which in turn allows for not only in class eLearning but also mobile learning (mLearning). Parsons (2011) describes mLearning occurring when students interact with technology and artefacts created for learning purposes, not only when they are mobile but learning through or with mobile devices (p. xvi).

There are various views of how students relate to the use of technologies from the young, who according to Nigel Latta (2016) should not use a screen before two years old to the ‘digital natives’ who have been bought up with Web 1.0 and Web 2.0 technologies. Digital natives was a term coined by Marc Prensky (2001) and he describes these students as those who “are all ‘native speakers’ of the digital language computers, video games and the internet” (p. 1).

Regardless of the background of today’s learners, there needs to be new approaches adopted to learning methods. Young people are capable with their use of digital technologies and often use them in different ways from adults. However studies by: Bennett, Maton, & Kervin, (2008); Ebner & Schiefner, (2010); and Lorenzo & Dziuban, (2006) have reported that of all the students that have access to and are able users of technologies many are still lacking in media literacy as is shown in their low judging and reasoning scores. Furthermore, in Woulfe’s (2014) article, *The superstar learner*, she discussed John Hattie’s and the University of Melbourne’s Education Research Institute study of how infants start building knowledge. One of the findings showed where if a child does not learn to

read by the age of eight then they struggle to gain the required amount of language to catch up with their peers (p. 16). This could eventually lead to the struggling child being unable to analyse online content effectively if appropriate language skills are not taught.

Not only do we need to teach students in high schools how to use these digital technologies effectively, we need to also decide what we teach our students so they can participate successfully in the communities of the future considering we are not entirely sure of the kinds of jobs there will be and how technology will evolve. Jonassen (2013) points out that "modern educational technologies have been conceived most frequently as instructional communicators, mediated teachers, and knowledge conveyers" (p. 102) in the time since they were conceived. In education if technology is used as an information transmitter, as when teachers sometimes use Learning Management Systems (LMS), then this is just a small part of educational practice (pp. 102-103).

In order to transcend the transmissive view of education, Jonassen (2013) looks to Pea (1994) who found that thinking about learning and education needed a new approach with computer-supported collaborative learning (p. 297). He argued that it was important for teachers to facilitate new ways of thinking, knowing and acting in education (Jonassen, 2013, p. 106), therefore looking at the way students learn is an important component of how we use technologies to teach. Jonassen further stated that "students learn from thinking in meaningful ways" and learning "*with* technologies rather than *from* technologies" actually "enhances their thinking and learning" (p. 106).

Steve Wheeler, sometimes referred to as the eLearning guru, in an interview for the February 2014, Interface magazine (New Zealand's educational computing magazine), was excited by the potential of technology supported learning in education. When asked to describe digital learning, he said "Learning is learning. Whether you use technology or not it is relative" (p. 16). He continued by discussing what he was presenting as keynote speaker at the 2014 mLearn conference. This was where he argued that we all "have a hand in shaping the future and we'll

need to be proactive and engaged fully with our professional field at a global level to be able to do this effectively" (p. 17). Like others, he sees technology as just another tool that we can use in a learning environment.

This sentiment was echoed in an interview with Richard Watson, by Blundell (2016), regarding his latest book, *Digital vs Human*. Watson, explains that the jobs that will remain secure in the future are those requiring us to "understand, inspire or connect with other human beings" (p. 20). Therefore students should be taught what the machines will not be able to do and "to ask questions, think creatively, act empathetically" (p. 20) and we need to have these discussions on how we envisage our future lives and how machines will assist human well-being and progress with dignity and respectfulness (Blundell, 2016).

2.2. Pedagogy and the introduction of digital technologies

Despite time or financial constraints on teachers inhibiting their desire to start or complete a research project in a tertiary institution, some have found they are able to. This is usually to assist with the development of their teaching practice and pedagogy. The demands on teacher time and energy have seemingly increased with the addition of professional learning not only in advancing teacher practice but also the huge task of including digital technologies into their teaching and learning programmes. As discussed in a previous sub-chapter, documentation by Ferguson (2009) showed changes in the New Zealand technology curriculum over the years 1995 to 2007 have culminated in the current technology curriculum (New Zealand Ministry of Education, 2007). This has also meant extra professional learning for teachers, for each stage, as it has been developed over several years with different draft versions in between.

Technology teachers who came from a manual training background, have had to continually update their programmes of work, firstly from the previous manual woodwork, metalwork, cooking and sewing lessons, to technology units of work to fit the new technology curriculum. Furthermore, developing skills for students to gain technological literacy so

they can undertake technological practice, along with gaining 21st century digital technology learning skills, has been challenging (Compton & Harwood, 2005; Compton & France, 2007).

There has been some interest in the incorporation of ICT and digital educational technologies in teaching and learning in food and textiles technology education (Daulton, 1997; Williams, 2000; Jenkins, 2008; Parkes et al., 2011; Walker & Kim, 2015). These have included several studies from the United States of America in the Family and Consumer Sciences curriculum area which include Daulton's (1997) historical perspective of *Microcomputer adoption by family and consumer sciences teachers: An historical perspective;* through to Williams (2000) thesis which looked at: *Family and consumer sciences teachers' attitudes toward and stages of adoption of information technology*; Jenkins (2008) *Computer literacy, access and use of technology in the family and consumer sciences classroom* at the University of Kentucky and more recently Walker & Kim's (2015) study of *Family Educators' Technology Use and Factors Influencing Technology Acceptance Attitudes*. In New Zealand there have only been a few studies of digital technology integration including those by: Pendergast, (2009); Parkes et al., (2011); Dixon, (2016); & Mangan, (2016) in home economics and technology education.

Ho (2010) completed her dissertation: '*A study of Hong Kong home economics teachers' adoption of information and communication technologies'* and presented her findings at the SITE conference in the same year. Her presentation was titled, *Hong Kong home economics teachers' preparedness for teaching with technology* (Ho & Albion, 2010). Their paper showed that home economics teachers had positive attitudes towards including ICT in to their lessons. Mangan et al. (2012) in their research in to the integration of ICT in New Zealand technology classrooms argued that, "teachers are not necessarily well prepared to integrate them effectively into their pedagogy." (p. 1), and this presented a real challenge (p. 7). Mangan's dissertation completed in 2016, showed how support in the way of professional development and the use of

TPACK, even though she believes it “is a complex concept, the framework offers a useful tool for communication, development and analysis of the knowledge needed for effective integration of ICT.” (p. 53). Similar findings from both of these studies include barriers such as limited computer access and resources, time for teachers to gain confidence in using digital technologies in their pedagogy and professional learning opportunities for teachers were common.

Also the effective pedagogical use of digital technologies within a teacher’s programme is seen as an important component of the successful integration of web based resources, ICT and DTs. This applies particularly in food and textiles technology which requires critical thinking modes of inquiry within highly structured subject content. There are often many opportunities where students and teachers are required to problem solve, reflect on social issues, both micro (individual) and macro (world-view). The addition of digital technologies to teaching can be beneficial in encouraging students to concentrate on questioning and critical thinking techniques (Eyre & Peterat, 1990).

2.2.1. Barriers and affordances of digital technology

Barriers and affordances of integrating digital technologies are an integral component when planning their incorporation into the classroom. Schools, teachers, students and sometimes their communities can be affected by the outcomes so careful consideration of all the possibilities need to be thoroughly thought through along with the many options available. Barriers to the integration of digital technology can be divided into four main categories. According to Brinkerhoff (2006) these are classified as “resources, institutional and administrative support, training and experience, and attitudinal or personality factors” (p. 22). Wright (2010), (in a literature review report on eLearning and its implications for NZ schools), found along with the categories above that from the students’ perspective, the motivation and engagement paramount to their success could cause more barriers if not present in a classroom.

External and *internal barriers* determined by Ertmer (1999) where first order, *external* barriers, include the four main categories described by Brinkerhoff (2006) and second order, *internal* ones "relate to teachers' beliefs about teacher-student roles, as well as their traditional classroom practice including teaching methods, organizational and management styles, and assessment procedures" (Ertmer, 1999, p. 51). Over time, first and second order barriers have been slowly addressed and are continuing to be so but there is more needed to assist teachers with the incorporation of digital technologies into their lessons.

The rate of change has been slow in terms of the use of ICT and digital technology integration, as overwhelmingly New Zealand principals identified the costs of digital technologies and maintaining online services were the biggest barrier to their use by schools (Johnson, Wood, & Sutton, 2014). This external, resource based barrier has been partially addressed with the introduction of Bring Your Own Device or BYOD in some New Zealand schools. The upkeep and maintenance is now an additional cost to a family, rather than the school, who purchase or lease digital equipment and which saves the school costs in these areas. Johnson et al. (2011) found earlier that this can help solve resource issues of keeping up to date with the latest technologies and as hey explained, the associated "cost of ICT equipment, the cost of upgrades, the speed of technological change and technical support" (p. 7) when it is no longer the responsibility of a school.

A benefit that this affords to students along with access to a 1:1 computer, is that as schools increase the use of blended learning the students need for continual access increases. This has not always been possible due to overbooking computer labs or networks of portable devices. Teachers planning to use digital technologies might find that not all their students have access when required, making the delivery of the lesson difficult. Teachers will often need to be creative with the digital resources they have available to them, often getting students to share, using data projectors to gather whole class feedback and then sharing the information with them.

Other methods of instruction that do not require using digital technologies may also be used.

Resources including teachers as resources are an important affordance and when there is a lack of support from school management then the integration of digital technologies can be restricted. Knowledge concerning digital technologies and how they work within the school can also assist integration within the school environment especially when specific and targeted professional learning has been provided (Mangan, 2016; Parkes et al., 2011). Earlier, Kagima and Hausafus (2001), included factors affecting the adoption of computer technologies such as “career concerns, lack of institutional support, fear of being replaced by the technology, and the lack of technological competence” (pp. 34-35). Although they had these concerns they also found that there were opportunies from the new emerging digital technologies which allowed teachers to explore learner directed pedagogical approaches further (p. 35).

Demiraslan and Usluel (2008) agreed that the development of social relationships between learners by including “new learning activities, improved collaboration mediums, novel assessment models, and curriculum changes which introduce more visual stimulants in the learning environment” as described in Adhikari, Mathrani, & Parsons, (2015; p. 1) would also make learning with digital technologies a rich experience. This along with the authentic learning experiences which can be generated with food and textiles technology make it an important and necessary subject area for digital technology integration. Specialist teachers can develop a classroom culture of thinking in technology education, understand the culture of the food and textiles technology subject areas along with the health and safety aspects required to be used in practical lessons. These teachers are an integral part of an education setting and difficult to replace component for the development of lifelong learning for students.

The environment where students learn and are able to gain rich learning experiences also needs to be considered as more schools are beginning to have 1:1 devices or BYOD. A classroom culture, where students are thinking about how to gather information for their learning and where they

develop the confidence and ability to share their knowledge with others is preferable to being in isolation with their devices. Developing a classroom culture of thinking is driven by teachers and many of the skills required for the layout, presentation and the communication of the student learning outcomes requires a teacher's expertise (Gray, 2004; Pohl, 2000).

Access to computers and internet connectivity is an important component for students to be able to learn anywhere, anytime. Charitable trusts like Manaiakalani Outreach (https://sites.google.com/a/manaiakalani.org/manaiakalani-outreach/home), and Computers in Homes (https://computersinhomes.nz/) have been looking at assisting with making digital technologies more accessible to all New Zealand children. Companies like Spark with their Jump initiative have partnered with Manaiakalani and the 20/20 Trust, mentioned here in their research capacity also, "The 20/20 Trust works across New Zealand to foster digital inclusion, digital literacy and digital skills, and over 20 years has helped tens of thousands of New Zealanders" (20/20 Trust, 2018. Para. 1). NetNZ also provides online learning opportunities to students, anywhere, anytime with eTeachers and eDeans (Lai, 2017).

Having digital technologies available in the classroom is a valuable tool and resource for both the teacher and the students. It can be a challenging process gaining access to these and also the relevant skills required to operate the technology. Adhikari et al., (2015) discovered that even though "students may have very good access to technologies and digital skills to operate one-to-one devices … if they don't have enough skills to process and apply the information given to them, they are still going to struggle in their learning" (p. 8). The students along with the teachers need time to embed the knowledge required to use technologies effectively and choose the most useful technological tool for the task. In her thesis, Hunter (2013) also agreed that "much of the research found that providing opportunities for teachers in schools to witness how the integration of technology benefitted students, and finding time to play with technology, were essential" (p. 23).

Principals in New Zealand schools surveyed by Johnson et al. (2017) understood the need for teacher professional development but the teachers required time for up-skilling which half the principals in the survey found difficult to provide. Seven out of ten principals found staff professional development a barrier along with "the speed of technological change, extracting value for money, … and parent support for use of digital technologies." (p. 11) and even more than eight-in-ten principals reported the following were moderate to major barriers for their school, in relation to the use of digital technologies for learning:

- The cost of digital technology equipment
- The cost of upgrades to equipment and software
- The affordability of personal digital devices for parents
- The cost of online services.

These barriers might not be the same for all countries but these kinds of external barriers were recognised by Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, and Sendurur (2012) as being not as important as second order barriers, especially if they had been addressed, for teachers to overcome to "achieve meaningful technology integration" (p. 434).

Several surveys on *Attitudes and beliefs towards technology* reviewed by Ho and Albion (2010), appear to show how important teachers' beliefs are regarding their pedagogical practices (p. 116). Mumtaz (2000) made the importance of the role of the teacher and their beliefs regarding the integration of ICTs clearly evident along with the importance of the "role of pedagogy" (p. 319). Today, Benade (2017) discusses, the ubiquitous nature of technology can be a stronger force over the teacher beliefs adding to the "mental shifts and sometimes-painful transitions teachers and leaders are making and experiencing, as they move through uncharted waters, from traditional classroom practices to ones emphasising collaboration, teamwork and the (sometimes) radical de-centring of their personal roles" (p. 2) and this can add to the pressures of teaching. John & Wheeler's, 2012, findings included that when teacher agency is taken away it may affect the integration of technology and this could be a huge barrier. They further "recognised that teachers hold the

key to future developments and that without their commitment to ICT use, many of the opportunities to innovate and even transform education and learning will be lost" (p. 15), and this would make the greatest asset the teacher.

The Education Innovation and Research report from the Organisation for Economic Co-operation and Development (2016) found that "although they cannot transform education by themselves, digital technologies do have huge potential to transform teaching and learning practices in schools and open up new horizons. The challenge of achieving this transformation is more about integrating new types of instruction than overcoming technological barriers" (p. 10). So the importance of assisting teacher agency by continuing to "reinforce that schools should attend to the combination of contextual factors, not the technology itself, to be successful in improving teaching and learning via technology (with) supportive leadership, ongoing, teacher-driven PD and technology infrastructure" (McKnight, O'Malley, Ruzic, Horsley, Franey, & Bassett, 2016, p. 208). This along with teachers sharing effective tools, knowledge and best practice can be encouraged by school administrators and leadership. Schrum and Levin (2013), also suggested that "School leaders have the responsibility for creating an educational culture and environment that improves student outcomes and supports opportunities for all" (p. 397) when integrating technology to improve student engagement and achievement outcomes.

2.2.2. Models for integrating digital technologies in education and their uses

Within the education research community there appears to be a few recognised models used to help explain the integration of digital technologies. These models can be used to understand whether digital technology integration can be effective or not and how links could be made to pedagogy. Several that have been found useful are the Substitution, Augmentation, Modification and Redefinition of the SAMR model; the Technology, Pedagogy, and Content Knowledge of the TPACK

model and the Teaching as Inquiry or TAI model used here in New Zealand. Sometimes digital technology professional development in schools will include the Substitution Augmentation Modification Redefinition (SAMR) or SAMR model to assist teachers to assess their incorporation of eLearning in their lessons (Ministry of Education, 2017c). It was developed by Dr. Ruben Puentedura and used in his Transformation, Technology and Education presentations (2006). It is a "clear and concise set of categories that define the nature of technology use in a learning situation. There is a clear progression from technology used to enhance learning to digital tools used to transform learning" (Oakland Schools, 2014). Depending on the digital technology task, any one of the four areas on the SAMR model could be used for the learning goal.

It is an easy to understand this hierarchical tool, giving the user different stages or a simple explanation and categorisation for their integration of ICT techniques for eLearning. In 2014, Green discussed the validity of the SAMR model even though it was very popular and had been made into many different visual aids (see Figure 3). She argues that the focus should be on "designing technology-enabled learning experiences" rather than a tool or digital application (p. 42). For this study it was anticipated that the participants would recognise this model and be able to explain where their teaching and learning with Web 2.0 tools sat within it.

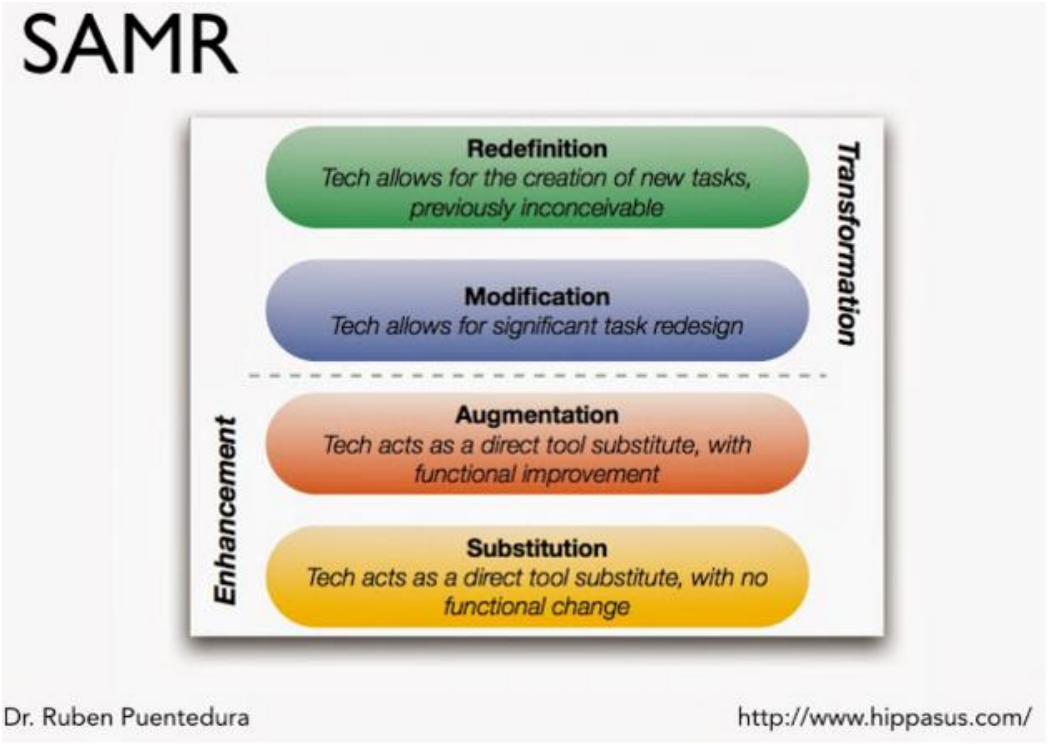

Figure 3. SAMR model From *Hippasus* by Dr R.R. Puentedura, 2006. Retrieved from: http://hippasus.com/blog/. Reprinted courtesy of the Copyright Holder under a Creative Commons License 3.0.

Further research of the SAMR model by Green (2014) found that although there was little to no research supporting the model and that it was very similar to one developed by Hughes (2005), “in which three functions of technology were identified: a) replacement, b) amplification, or c) transformation” (Green, 2014, p. 39). Green (2014) also found the explanation to be “strikingly similar to the SAMR model” (p. 39).

The SAMR model has been widely used in professional learning for the introduction of ICT and digital technologies in secondary schools here in New Zealand and a number of schools in the United States where it is sometimes used as a framework to guide teachers’ pedagogy when introducing digital technologies (Sheninger, 2017). In New Zealand, several presenters at the Future Education and Technology summit held in Auckland (March 2015) used it in their presentations including Marion Stewart from TTS school partners, Russell Dunn from Tamaki college and other educators from various New Zealand secondary schools. Secondary schools where this researcher has worked have also used it in

professional learning sessions when integrating digital technologies. The conference referred to above, was where Dr Karen Poutasi also discussed NZQA plans, in her presentation *Digital Transformation of Assessment as part of the NZQA Future State*. In this she explained that NZQA aimed to have all secondary student external examinations completed online by 2018 and all examinations completed online, anywhere, anytime by 2020s. A factsheet is available that describes this initiative. (http://www.nzqa.govt.nz/assets/About-us/Our-role/innovation/DA-Factsheet-May15.pdf). The SAMR model was used in the NZQA presentation for further information on this innovation at the SPANZ Principal Conference (Secondary Principals' Association of New Zealand) in 2017 and acts as an example of how the model can be used to show digital technology enhancement through to transformation in education. (Poutasi, 2017).

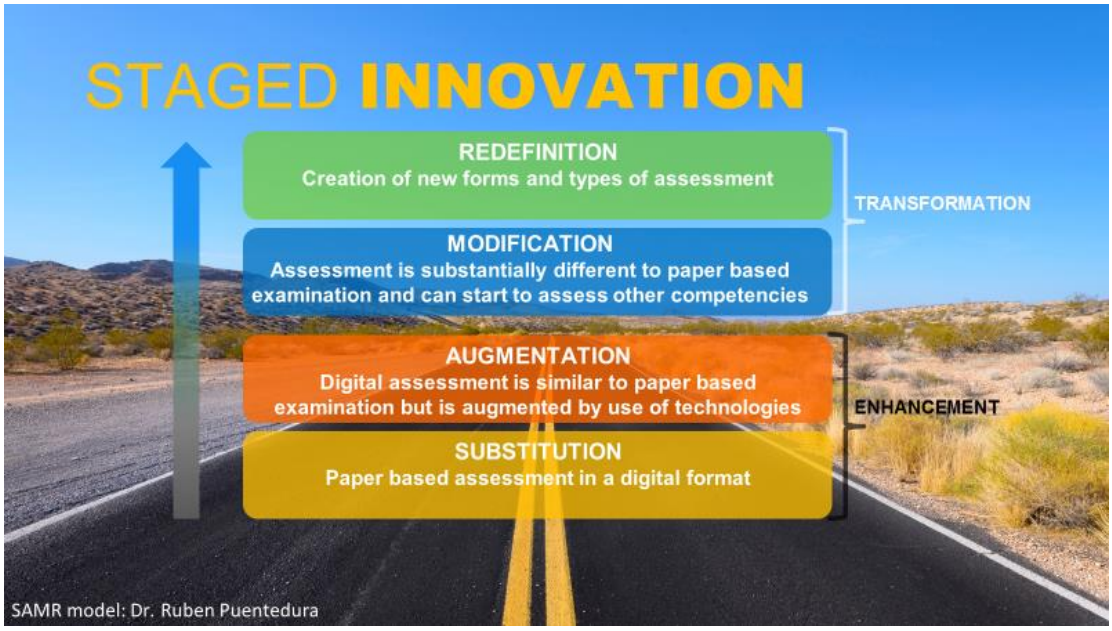

Figure 4. Slide from NZQA presentation for SPANZ conference by K. Poutasi, 2017. Retrieved from: http://www.nzqa.govt.nz/about-us/future-state/presentations-videos-and-factsheets/). Reprinted with permission.

The TPACK model has been used in research for some time to look at the key issues surrounding teacher integration of digital technology into their classrooms. Mishra and Koehler (2006) began to develop their model from Shulman's (1987) model of PCK (pedagogical content knowledge) and it became TPCK with technological knowledge included for the introduction

of ICTs in lessons and “to describe how teachers’ understanding of educational technologies and PCK interact with one another to produce effective teaching with technology” (Koehler & Mishra, 2009, p. 62). In 2009 it became known as the TPACK model as it was found to be a good indicator for teachers complicated interweaving of specialised knowledge when developing programmes for students that included digital technologies. The diagram of the model below (see Figure 5) shows the interconnection between each component (Koehler & Mishra, 2009).

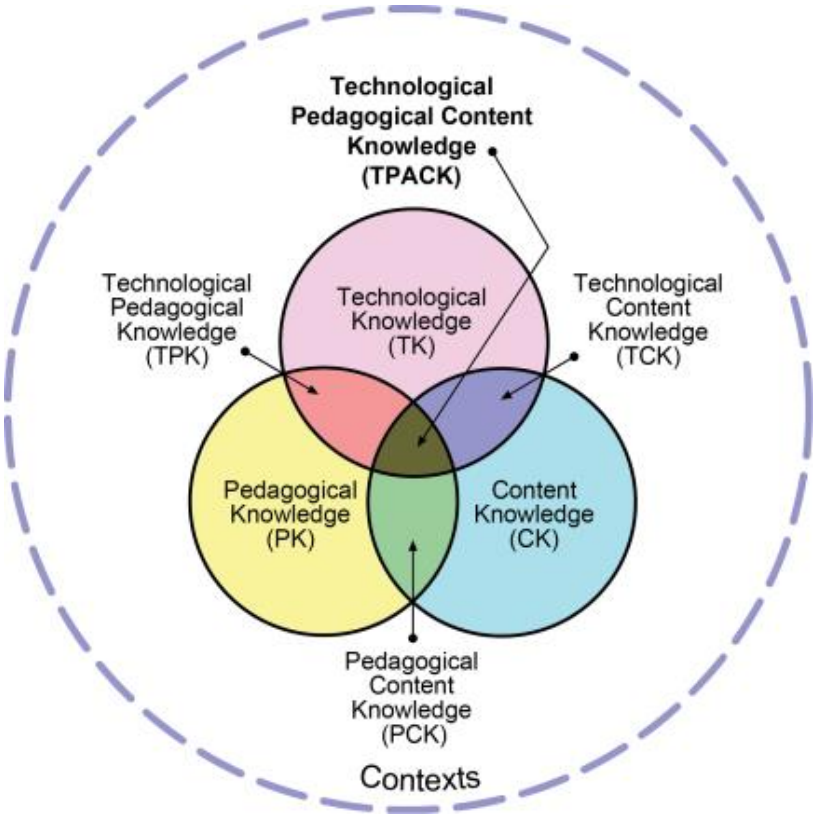

Figure 5. TPACK model. From TPACK.org, by M. Koehler & P. Mishra, 2009. Retrieved from: http://tpack.org. Reprinted with permission of the publisher, © 2012 by tpack.org.

Figure 5 also shows the inter-relationships between technological, pedagogical and content knowledge (TPCK) and a simplified explanation of the content, pedagogical and technological knowledge domains follow here. Content refers to the subject specific knowledge being taught, pedagogical knowledge is how to teach that specialised knowledge effectively to your students and technological knowledge is the use of

technologies (information and communication or digital) to assist with the teaching and learning process. This is a complex interplay of factors originally used for “teacher professional development and faculty development in higher education” (Mishra & Koehler, 2006) and was developed because it became clear that just introducing technology into “the education process was not enough to ensure technology integration since technology alone does not lead to change” (Mishra & Koehler, 2005, p. 152). To effectively integrate technology into teaching and learning programmes the combination of these factors are an important factor.

When we bring the combination of Technological Pedagogical Content Knowledge (TPCK) together “teaching and learning can change when particular technologies are used in particular ways” (Koehler, Mishra, & Cain, 2013, p. 16). One example in food technology is when you are required to work with the health and safety issues of working in a kitchen and not only is the teacher responsible for the health and safety of the students working in the room but also those who will eat the food they prepare, as this is partially the content component. The pedagogical part is how we are teaching the students good hygiene and food safety, which involves not only during the practical work but also the knowledge of different pathogens and how these bacteria, viruses and other organisms can make us sick and, at worse, kill us.

The technological component then sits to one side of the PCK as we consider the best way to integrate technological resources and eLearning to assist the teaching and learning of good hygiene and food safety skills in this instance. When we add the technological use of either, computers, mobile devices and/or equipment to assist with this process, it appears to be a complex mix.

Figure 6. An example of links between content and pedagogy with technology in food technology.

Figure 6 showing how digital technology sits alone until it is incorporated to assist students learn about hygiene and food safety skills within food and technology programmes. The digital technology component will, in a best case scenario, link the content with the pedagogy when it is included effectively and preferably for free. The reason for this is answered by Koehler and Mishra (2009) as the programme design of applications is often for purposes other than education (p. 66). When we discuss shoe-horning technology in to teaching programmes, this is often because of the lack of appropriate educational tools available. It takes teachers a lot of time to know what is the latest available App (application) to do the task and to learn a new programme. So until dedicated educational digital tools and programmes are written for food and textiles technology and hospitality areas, teachers need to adapt what is available as best they can and design their own technological learning activities.

Another tool to assist teachers with choosing the best eLearning strategies is the Teaching as Inquiry (TAI) model. The New Zealand curriculum devotes three pages in its document to effective pedagogy. Recommended within this is the “teaching as inquiry” strategy and also how eLearning using ICT can support student learning (New Zealand Ministry of Education, 2007). The outcomes for New Zealand education would see students who are “lifelong learners who are confident and creative, connected and actively involved” (Sewell, 2007, p. 4).

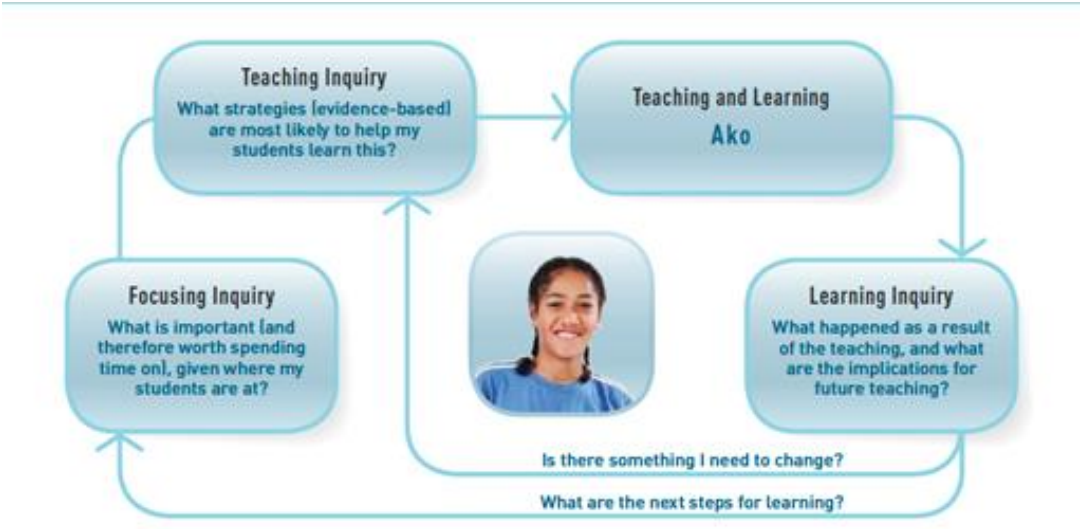

Figure 7: Teaching as Inquiry model from the New Zealand Curriculum, 2007. Retrieved from: http://nzcurriculum.tki.org.nz/Curriculum-stories/Case-studies/Teachers-as-learners-Inquiry/Teaching-as-inquiry Reprinted with permission of the publisher. (Please Note: The diagram may not be used by any other person, or organisation, without first gaining the NZ Ministry of Education permission).

The Teaching as Inquiry or TAI model was developed for teachers to use inquiry practices in an educational environment. This can occur in different ways and Team Solutions staff (the University of Auckland's educational departments professional development service for teachers to improve outcomes for their students (University of Auckland, 2018) developed this grid to explain the TAI model along with inquiry learning and how they can be used.

Table 3

Inquiry in the education context.

Inquiry in the education context	
Teaching as inquiry	**Inquiry learning**
Where **teachers** inquire into their **own practice** and use **evidence** to make decisions about ways to change that practice for the benefit of the students	A process where **students** co-construct **their learning** in an authentic context
Brings about effective teaching and learning	Is an integrated process for examining issues, ideas and themes
Is a continuous, reflective, iterative and cyclical process	May be used in a particular context for a clearly identified outcome
Is about evidence-based pedagogy	Could be part of the Teaching as Inquiry process
The model in *The New Zealand Curriculum (p35)* includes three phases of inquiry: 1. Focusing inquiry: *What is the most important and therefore worth spending time on?* 2. Teaching inquiry: *What might work best? What could we try?* 3. Learning inquiry: *What happened? Why did it happen? What might happen next?*	Many explanations and definitions exist. Some useful resources are: *The New Zealand Curriculum (social sciences),* http://nzcurriculum.tki.org.nz/The-New-Zealand-Curriculum/Learning-areas/Social-sciences *Galileo Educational Network,* http://www.galileo.org/inquiry-what.html *The Conceptual Age and the Revolution School* v2.0, Mark Treadwell, 2008

Note. (Team Solutions newsletter: Term 3, Issue 3, July 2009).

Williams (2007) also suggested that eLearning could be supported by inquiry learning where teachers have “time to think and prepare for e-network supported student engagement that goes beyond learning facts, but also students learning what it means to collaborate, explore, create and share technological ideas” (p. 12). Teachers need to scaffold, guide and support the students through this process. In a discussion of blended learning, Vaughan, Cleveland-Innes, and Garrison (2013), also found that “personal reflection and shared discourse are requisite for higher learning and, practically, are best realized in an education community of inquiry” (p. 11).

2.2.3. Why use the SAMR, TPACK or TAI models?

Pedagogy is an important component of the teaching process. The importance of knowing what to teach and when to teach it, is an intrinsic part of a teacher’s skill set. Pedagogical knowledge is developed in an individual way based on previous experience and can be continually

developing or developed. This is reinforced by Owen-Jackson (2008) in the field of design and technology education. This pedagogical knowledge is referred to as “how the subject is presented to pupils, the illustrations, explanations and analogies used to help them understand the concepts and knowledge” (p. 256). This may be the same for the integration of digital technologies – with each teacher’s individual experiences of digital technology prior to and during their teaching careers making an impact.

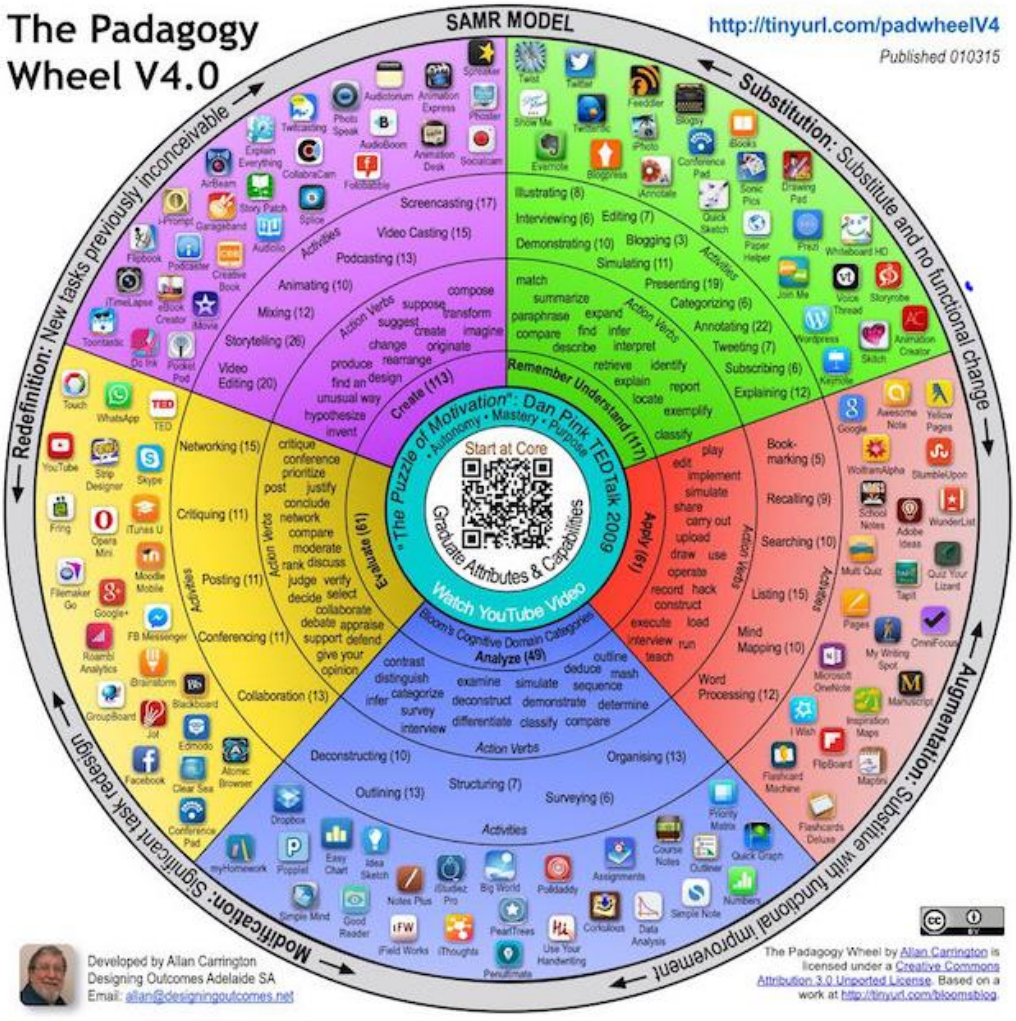

Figure 8. Visual aid using SAMR along with ipad applications, 2015. *The Padagogy Wheel V4.0* by A. Carrington. Retrieved from*:* *www.unity.net.au/allansportfolio/edublog/?p=874>*. Reprinted with permission of the publisher.

The above Figure 8 shows the use of the SAMR model with the integration of ipad applications. It has also been useful in other contexts including

research by van Oostveen, Muirhead, and Goodman (2011) who used the SAMR model to study tertiary students' "perceptions of the benefits of tablet PCs to their learning" (p. 79).

The Padagogy Wheel is designed to help educators think about how they use mobile apps in their teaching and advises this should be "systematically, coherently, and with a view to long term, big-picture outcomes" The underlying principle of the Padagogy Wheel is that it how we teach that should determine our use of educational apps, (Carrington, 2015). In addition, it also shows how SAMR can assist. The New Zealand enabling eLearning website describes SAMR as:

> A framework through which teachers can assess and evaluate the technology used in the classroom. As teachers move along the continuum, computer technology becomes more important in the classroom but at the same time becomes more invisibly woven into the demands of good teaching and learning. (Ministry of Education, n.d., para. 2)

Using this as the initial indication of ICT developed tasks seems appropriate for this study and a deeper analysis could be carried out with the TPCK model (Mishra & Koehler, 2006). The TPCK model originated from pedagogical content knowledge (PCK) developed by Shulman (1986) and was further adapted to become the TPACK framework, as explained earlier. It is more frequently recognised within research than the SAMR model with an excess of 300 studies completed on its efficacy. The TPACK visual representation in Figure 9 shows some of the underlying complexity of the interrelating areas which seem ideal for this study. Along with the diagram of the Seven Components of TPACK, (see Figure 4), Koehler (2012), explains further that;

> Effective technology integration for pedagogy around specific subject matter requires developing sensitivity to the dynamic, transactional relationship between these components of knowledge situated in unique contexts. Individual teachers, grade-level, school-specific factors, demographics, culture, and other factors ensure

> that every situation is unique, and no single combination of content, technology, and pedagogy will apply for every teacher, every course, or every view of teaching. (Para. 3)

Also the TPACK framework “attempts to identify the nature of knowledge required by teachers for technology integration in their teaching, while addressing the complex, multifaceted and situated nature of teacher knowledge” which can be further explored, in Figure 9 below. This shows the three types of knowledge teachers draw on as they design their teaching and learning, and questions they might ask as they consider the integration between PCK, TPK and TCK to best suit their learners needs.

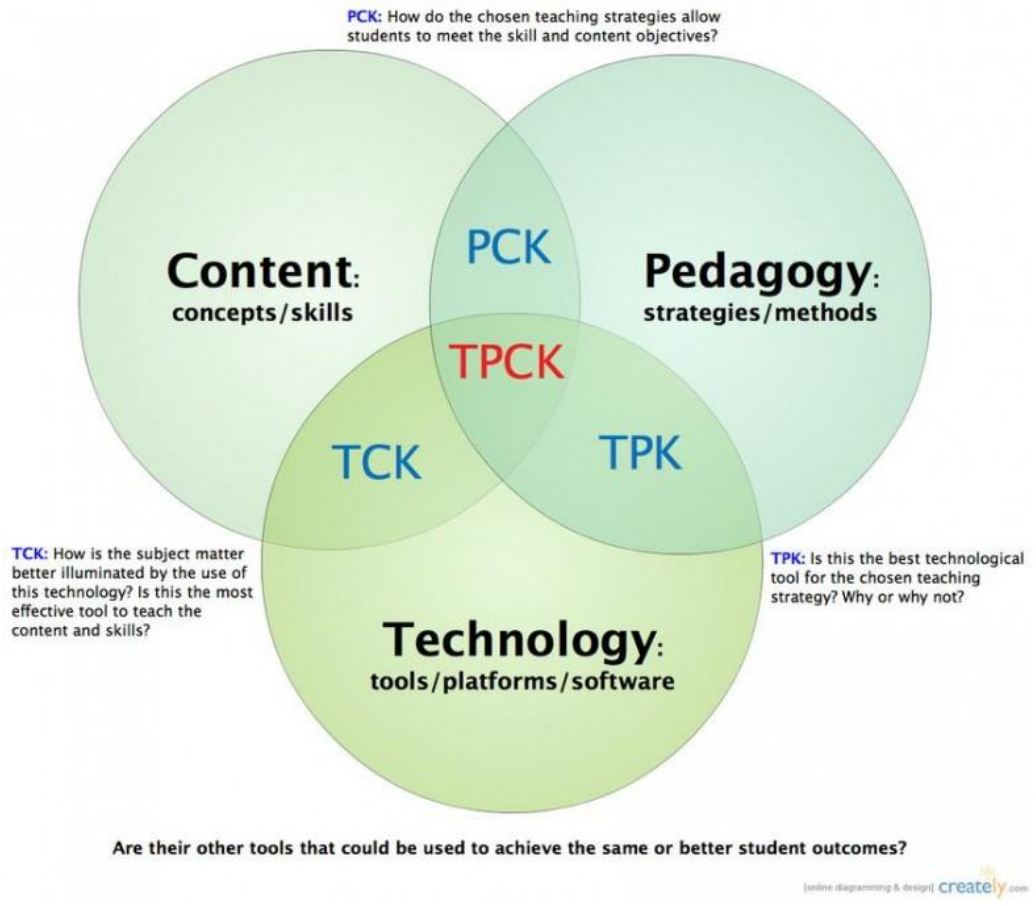

Figure 9. Adapted TPACK model. From Oakland Schools Literacy by Oakland Schools, 2014. Retrieved from: http://www.oaklandschoolsliteracy.org/resources/technology/

Teacher knowledge consists of more than just content or pedagogy. Shulman (1987) defined pedagogical content knowledge (PCK) as the unique amalgam of content knowledge and pedagogy that enables subject

matter to be transformed for teaching, arguing that teachers not only need to understand content and purpose, but be able to transform this in ways that make it pedagogically powerful (in Jones, Buntting, & de Vries, 2013, p. 200). TPACK assists educators to use “effective teaching with technology” and where digital technology can be used “in constructive ways to teach content, knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face, knowledge of students’ prior knowledge and theories of epistemology (Koehler et al., 2013, p. 16). In 2006, Mishra & Koehler had already pointed out simply that, “The TPCK framework allows us not just to understand what effective teaching with technology is about, but it also allows us to make predictions and inferences about contexts under which such good teaching will occur” (p. 1045).

There is no single solution here but a system that can assist in allowing the combination of unique factors to consider when developing a technological solution for individual teachers and their students’ needs. The Teaching as Inquiry (TAI) model used in New Zealand is a tool also used by teachers to inform their teaching and student learning process. This links in well with the TPACK concept as it is a reflective process and enables teachers to follow a cycle to help them create the best tools for the outcomes of their students in a reflective manner. When used by teachers to purposely develop teaching practice this short cycle is best suited to their learners’ needs, as it works from baseline data and evidence to inform their practice. Looking at past achievements and setbacks of the students in a previous focusing inquiry, the teacher can then develop strategies to move these students forward in their learning. The learning inquiry is “where the teacher investigates the success of the teaching in terms of the prioritised outcomes” (New Zealand Ministry of Education, 2007, p. 35).

What appears to be missing here is the wider learning community’s voice as we develop our programmes. To this end, Timperley, Kaser, and Halbert (2014) have written a paper that “argues for a “sea change in learning settings for young people” and have been developing the spiral of

inquiry for use in professional learning development. This change was bought about to include learners, their families, and their school communities so that links can be made between these important contributors to the learning process and develop students as lifelong learners. The researchers looked at practice throughout New Zealand, Australia, and Canada, where they have seen “educators, learners and their communities construct new and more innovative learning environments together” (p. 4).

This connection with the community, involving both learners and their families was considered possible through the use of the spiral of inquiry model. This technique describes what is happening for students and includes them in their learning process. They work through a series of different activities which include: scanning, focusing, developing a hunch, learning, taking action and checking and how these are interconnected with the aim of creating a new type of learning (Timperley, et al., 2014).

This would seem to suggest the latest Communities of Learning | Kahui Ako (CoL) initiative which is currently underway in school neighbourhoods may have been partially informed by the spiral of inquiry template. This initiative allows for school communities to liaise with local early childhood educators, and primary and secondary schools to meet current achievement challenges. Schools and communities will be able to draw on each other’s expertise and skills, sharing knowledge and experience gained along the way. The benefits afforded FTT educators would be manifold as important nutrition and life skills issues can be addressed by the Communities of Learning initiative. This in turn could bring great benefit for the holistic well-being of students and the communities that are served (Ministry of Education, 2017a).

2.2.4. Integration of digital technologies in New Zealand classrooms

Integration of digital technologies into secondary school classrooms is increasing as BYOD and 1:1 device learning is becoming the norm. The New Zealand Ministry of Education (MOE) has conducted research to guide them with their support for schools and their communities in order to

integrate digital technologies into the classroom. The goal is to transform how we teach and how our students learn in New Zealand primary and secondary schools. Several of these documents can be accessed from their website: www.education.govt.nz. This willingness to provide “high quality, high capacity, ultrafast internet access” to “offer today’s students and teachers easier, affordable and faster access to information, teaching and learning resources, peers, experts and the wider community” (Ministry of Education. n.d., paras. 1-2) shows an enthusiasm and desire to use technologies available for educational benefit. Allowing huge numbers of people to access the internet at the same time allows for different learning experiences and which where appropriate, can be integrated into our programmes of work.

The complexity of the integration of technologies into educational learning situations is well documented (Gaffney, 2010; Tondeur, van Braak, Ertmer, & Ottenbreit-Leftwich, 2016). However, the possibility of a teaching and learning generational divide concerned some students who were researched. They thought that some teachers were not allowing them to use the skills they had already gained in digital technologies. However, the students also recognised that they “were lacking in the way in which they applied these skills to their learning” (Lymbery, 2017, p. ii).

Digital technologies initiatives driven by the New Zealand Ministry of Education have been informed by an illustrative draft vision for education in 2025. This document “Lifelong Learners in a Connected World” published in 2015, saw students as connected and life-long learners who can “take charge of their own learning, anytime, anywhere” and choose their own paths (New Zealand Ministry of Education, 2016b). Although the students are seen as capable in some areas of managing their own learning they need the guidance of the teachers to assist with their learning needs both digitally and in other ways, for example, socially or collaboratively. Lymbery (2017) argues however, that students though do recognise their teachers as having “content authority” and can guide them to the most appropriate and useful material sources (p. 211).

The draft curriculum change for 2018 where a component of digital technologies will be introduced as computational thinking will be taught to students in the first ten years of schooling and will have a funding allowance to assist with up-skilling or re-training teachers. The Education Minister at the time, Nikki Kaye began implementing this first change to the curriculum. The idea was initially introduced by the former Education Minister, Hekia Parata. Kaye said they wanted to invest in the education sector to make sure that young New Zealanders' have the skills to be digital creators and not just digital users so that these designers and inventors of the future can utilise digital technology to innovate and problem solve for the coming challenges (Collins, 2017a).

Pedagogical changes may need to be addressed as we integrate this new digital technology curriculum from Year 1 through to how it may evolve at tertiary education levels. The New Zealand Council for Educational Research or NZCER. (2004) has researched trends into the integration of digital technologies to gain "information about effective teaching and learning practices for eLearning in tertiary education." (p. 6). While there are many differences between tertiary and secondary school education there can be some areas where there is dual application. This was found in the background paper *Trends from recent thinking on effective learning* (New Zealand Council for Educational Research, 2004) where they compiled this following information from their research:

- E-learning should not be a mass of online material for individual access without guidance on how to learn from it effectively.
- Courses involving e-learning need to be planned for, and grounded in an understanding of the roles of teachers and learners, of learning , and or how students learn.
- The role of prior knowledge in learning is critical and must be taken into account in e-learning design. Ongoing formative assessment is part of this.
- The brain is a dynamic organ shaped by experences. Conceptual links are reorganised through active engagement with information in various contexts.

- Learning is an active process. It is the result of carrying out particular activities in a scaffolded environment where one activity provides the step up to the next level of development.
- Learning needs to be meaningful to learners and they should be supported in developing the skill of relating new material to what is meaningful to them.
- Learners should be enabled to be adaptable and flexible experts in their own current and future learning.
- Learning takes time and effective learning pracctices enable leaarners to work with materials from a variety of perspectives while they become fully conversant with it.
- Weaving e-learning into existing teaching and learning practices adds more ways for students to be actively and deeply involved with subject area materials.

Figure 10. "Trends from recent thinking on effective learning" From *Critical success factors and effective pedagogy for e-learning in tertiary education* (p. vii), by New Zealand Council for Educational Research, 2004.

Universities are leading the way in technology enhanced learning and as in the extramural students on Massive Open Online Courses or MOOCs. Introducing secondary school students to the possibilities of future lifelong learning is an important consideration when developing courses for them. Morgan (2013) described how "universities have an important role to play in understanding, arguing about and deciding exactly what role digital technologies should play in our institutions" (p. 19) and this may also impact on school environments as they develop skills to be able to matriculate in a tertiary learning environment and work in industrial fields.

The future needs of technology in the New Zealand curriculum considered by Granshaw (2015), looked historically at what could have been the most successful aspects of the technology learning area and how to incorporate them with the current and future needs of the subject area. Granshaw used his knowledge as a professional development facilitator to identify the future needs of technology students and the professional development requirements of technology teachers. The conclusion drawn pointed to a requirement for further research in this area due to the many issues identified in his study (p. 12). Professional development and learning for teachers is a key component for effective digital technology integration in

to the curriculum and classrooms (Lawless & Pellegrino, 2007; Mangan, 2016). Tondeur, et al. (2016) described “the meaningful use of technology in education” which support teachers in the correct context, and specific to the classroom culture is an important feature of this professional learning. A funding component for supporting teachers to accomplish this has been allocated by the New Zealand Government for professional learning in this area (Kaye, 2017).

Addressing the current educational needs of New Zealand students is paramount as there is evidence that we are starting to fall behind internationally. Collins (2017c) reported in the *New Zealand Herald* that according to the Emeritus Professor Warwick Elley, who has been analysing the position of New Zealand education and achievement gaps, according to the Programme for International Student Assessment or PISA testing, is finding that those countries with “high stakes” standards-based assessments have declining Pisa scores. The indication for “the three nations that have fallen furthest since Pisa began are all Anglo-Saxon: in order, Britain, Australia and New Zealand. The almost identical tracks of Australia and NZ suggest that there may be common factors driving us both down” (p. 3) and this could point to the similarity of the educational policies of these three countries. The technology subject area is not part of the Pisa testing that “over 4,500 students from 183 schools took part in the study in July/August 2015” in New Zealand (New Zealand Ministry of Education, 2016, p. 1). The two hour tests involve questions on “science, mathematics, reading, collaborative problem solving and financial literacy” (OECD, 2017, para. 2). These tests are analysed to see how learning is developing in different countries and what effective learning systems might look like. This is so we can “help students learn better, teachers teach better and schools to become more engaging learning environments.” (OECD, 2017, para. 7).

Other OECD researchers such as, Ananiadou and Claro (2009), have also explored the *21st Century Skills and Competences for New Millennium Learners in OECD Countries* including the most recent ‘Innovating Education and Educating for Innovation: The power of digital technologies

and skills' (OECD, 2016). These important publications are assisting New Zealand and other OECD countries with research that will guide educational innovation in MLPs. They will also help the integration of digital technologies into classrooms. The changes in development of digital technologies have been exponential and "developments in society and economy require that educational systems equip young people with new skills and competencies" (p. 5) yet New Zealand's curriculum has not changed since 2007.

Change is about to occur again with the New Zealand curriculum, as Minister of Education, Hekia Parata, announced at the NZ Tech Advance Education Technology Summit, in July 2016, that, "digital technology is to be formally integrated into the New Zealand curriculum and Te Marautanga o Aotearoa". The press release continues to describe the decision as "an outcome of the Government's Science and Social Strategic Plan *A Nation of Curious Minds: Te Whenua Hihiri I te Mahara* (Ministry of Education, 2016). This will impact on the way students interact with digital technologies into the future and perhaps the types of jobs that they will be doing in years to come. The OECD reports, along with many government funded research projects in New Zealand including the 21st Century Learning Reference Groups, *Future-focused learning in connected communities* published in 2014 and Wright's, 2010 report *e-Learning and implications for New Zealand schools: a literature review* may have helped guide this curriculum change along with other major reforms in education including provision for an online learning model called a "community of online learning" (COOL). The demand for skilled users of digital technologies in all industries, especially those with export potential, could also have influenced this change. (O'Riley et al., 2014; OECD, 2010, 2016; Wright, 2010). What will this mean for students entering food and textiles technology classrooms in the future?

Nikki Kaye, was committed to the changes made by the former Minister for Education and would like to see New Zealand children as "digitally fluent, healthy and well-rounded" (Collins, 2017b). This was reported in the New Zealand Herald on the day New Zealand parliament passed the bills for

both letting “children start school at age 4 years and 10 months and allow online only schools” (p. 2), or COOLs in May 2017. This is an online school with the possibility of no physical classrooms and where the “students work from home on computers, communicating over email or a web platform” (Jones, 2016, p. 1). Additional funding has been allocated to help ensure teachers are confident with the new curriculum, as “it’s important that teachers have the necessary knowledge and capability to teach the new curriculum content, so we’ll be investing $24 million of new money towards additional professional learning and development for teachers,” (Kaye, 2017). The current Minister of Education the Hon Chris Hipkins, is also committed to “continue to work towards a quality, free, public education system for all New Zealanders” (http://www.chrishipkins.org.nz/) which will focus on providing what is required for life-long learning opportunities and 21st century skills (http://www.chrishipkins.org.nz/education). The Labour party education policy included establishing “a comprehensive plan to ensure that all school students have access to mobile digital devices” (Kirton, 2017. Para. 6). Hopefully this will maintain the impetus of the National party policies for digital learning.

A study of an Auckland secondary school, with two years of students bringing their own devices (BYOD) was conducted by Parsons and Adhikari (2016). This reported on the introduction and continuing use of digital technologies in the school. This study can assist others with the integration of BYOD as again, there is limited research in this area. Along with checking research it is important to critically look at whose interests are being served with computer giants promoting the introduction of devices into schools. Students needs should come first in this situation, as they are the most affected, and the use of these powerful generators of information and communication can occasionally be detrimental when used in a negative or inappropriate way. We are faced with new learning challenges as well as wonderful potential for the integration of digital technology into secondary school classrooms. (Adhikari et al., 2015;

Parsons & Adhikari, 2016; Selwyn, 2013). These are all important considerations for food and textiles technology teachers.

Initiatives have been developed throughout the world in response to the needs of Home Economics, Food Technology, Textiles Technology and related subject areas. Ho and Albion (2010), whose research findings were for teachers desiring more subject specific professional learning and resources available for ICT with Home Economics content. Around this time, Law, Pelgrum, and Plomp's (2008) study of mathematics and science teachers throughout the world, where there was almost 100% access to computers internet for pedagogical use, they found "the extent to which teachers had adopted ICT differed enormously across systems, varying from below 20% of the teachers to over 80%" (p. 275). The study suggested that teachers pedagogicial understanding of the knowledge economy and the value of collaboration was understood, where learning and problem solving amongst peers was encouraged together enabled the positve integration of ICT learning into their programmes. Furthermore Law et al. (2008) believe that the orientation of the teachers pedagogical strategies to the adoption of ICT will impact on the students outcomes (p. 275).

Some of these findings were also echoed here in New Zealand. Harwood and Compton (2007) also agreed that "prior experiences and training of teachers also assist in determining the nature of the pedagogical practices that are used" (p. 105). Teachers with traditional backgrounds in technology education may have different "ideologies and learning theories that underpin traditional technical and technology education" (p. 105). Where computers and the use of ICT are concerned, with traditional teaching methods, teachers may find that there is no need to change their practice if they do not see any perceived benefits, unless it is for student-centred practice (Ward & Parr, 2010).

Tondeur et al. (2016) suggest that there is a complex relationship between "pedagogical beliefs and educational technology use" (p. 17), and along with the variances within school cultures, integration of digital technologies

and eLearning requires many components to be in place in order to be effective. What has also been found is that teachers exert a powerful influence on student learning and their pedagogical beliefs play a large part in how and what digital technologies they choose to use as part of their classroom practices (Alton-Lee, 2003; Ward & Parr, 2010). Interestingly, what was also posited was “sustained higher achievement is possible when teachers use pedagogical approaches that enable students to take charge of their own learning” (Alton-Lee, 2003, p. 85) and this is how using digital technologies effectively in the classroom can be applied. This may signal greater student use of inquiry guided learning, which includes “the acquisition of new knowledge, abilities, and attitudes through the investigation of questions, problems, and issues using the ways and standards of inquiry in the disciplines.” (Lee, 2011, p. 151). Gaffney (2010) discussed the use of TPCK and how it illustrated that teacher take-up of digital technologies was not only dependent on the teacher’s capability but also the cultural characteristics of the school they taught in. The use of inquiry guided learning as student motivation may “encourage students’ empowerment as learners rather than as recipients of instruction” (p. 10) when using digital technologies in their teaching.

2.3. Future developments of digital technologies in food and textiles technology education.

Digital technologies and eLearning may require new methods of instruction and pedagogies by teachers as they integrate them into their classrooms. Inquiry guided learning could also be a useful teaching tool for instruction in food and textiles technology, home economics, family and consumer sciences, and/or hospitality. Benade (2017) discussed that with problem based or project based learning approaches students can “work collaboratively, solving real-world problems” (p. 36) and this can encourage the development of new learning paradigms for the 21st century learner. The integration of eLearning and digital technologies, may call for teachers to be more creative and innovative with their teaching approaches. MacBeath (2012) adds to the discussion with how policy can

shape teacher practice. Where the school communities need to be "congenial, flexible and adaptable to new situations and new challenges" (p. 68). Furthermore, the traditional model of learning by transmission of knowledge is moving aside for "imaginative and stimulating pedagogies" (p. 77) which, where managed effectively, can be are offered by the new interactive technologies. Benade (2017) went further to explain that teachers are not only required to be more creative and innovative in their teaching with digital technologies, they also need to be "innovative in endorsing and supporting the social knowledge of students" (p. 38). This may conflict with "their commitment to their store of knowledge and experience" (p. 38) from past teaching habits which, in turn, could cause resistance to change.

The integration of digital technologies is an important component for developing the subject into the future but the legitimisation of the subject area has been even more pressing (Ma & Pendergast, 2011). The research available for the integration of digital technologies into this subject area are few and yet learning that involves healthy eating and nutrition is very important. There are rising concerns around obesity and other diet related illnesses in New Zealand and other countries where cardiovascular disease is the biggest killer, Professor Michael Williams maintains that nutritional knowledge will be paramount to guide eating habits in the young as this is where health problems begin (Miller, 2017; Parnell, Scragg, Wilson, Schaaf, & Fitzgerald, 2003). Nutritional education of the growing population and paticularly of our youngest students becomes more essential in the area of food and nutrition taught by the above subject areas. The ability to reach a wider audience of these young minds, using digital technologies, may be crucial.

A Position Statement, by Street (2006) which was commissioned in New Zealand as part of the Curriculum/Marautanga Project. The purpose of this paper was to:

1. provide an outline of the understandings (nationally and internationally) of what contemporary home economics education is
2. clarify the location of home economics within the draft materials for health and physical education and other learning areas
3. identify its relationship to the key competencies
4. identify barriers and enablers pertaining to students learning related to home economics (p. 1).

The well-being of all who live in this modern society and the skills needed to do this is at the core of this subject area. With the possibility of increasing healthcare costs and lack of nutritional knowledge and increasingly busy parents, how else will students be able to make informed decisions concerning their own health and wellbeing without the assistance of this important subject area? Along with this is the increasing demand for new tastes and flavours, new food products and developments not only in food production but also biodiversity and sustainability, food technologists and industry experts need to develop new methodologies for a more diversified and discerning audience. Hospitality also offers skills and knowledge not only with nutritional needs of clients but different methods of cooking and culinary information required to serve this clientele. Television shows like Masterchef and My Kitchen Rules NZ, along with Food Television provided by SKY (www.sky.co.nz a local pay for view television station) means that students can arrive to food technology classes with some prior knowledge along with what they have already been taught in the home. This is truly a lifelong learning subject area.

Unfortunately, despite these popular television shows, there is a lack of educational programmes and digital resources available for the teaching and learning of food and textiles technology. This makes the future integration of digital technologies in FTT areas an unknown as there is little to test and judge digital technology programmes of work and their possible usefulness. With Education Perfect available in New Zealand

schools for English, Science and Languages, also Photoshop and other subject specific programmes, food and textile technology is currently not catered for (excuse the pun). The complexity of the food technology and hospitality subject areas that covers many facets of home sciences, technologies, food types, packaging, food production and nutrition along with catering in the food area poses difficulties for future programmes. Textiles technology is equally diverse with history of garments and costuming, fabric making and textile design, pattern-making, garment design and dressmaking skills to name a few of the areas covered. Each appears as a single subject area but the students not only need to learn skills based topics but also the requirement to manage time, and the appropriate use of ingredients and materials. This includes knowledge around the scientific makeup and properties of these ingredients and materials, where they come from, and their many uses. Also the theory of nutrition or textiles, environmental factors in the use and development of foods and materials, how they interact together and the techniques required to either cook an acceptable dish of food or design and make a garment, are just the beginning of what FTT teachers are required to teach. Students need to learn to manage all these facets in both cooking, food development, textiles design and garment designing and making outcomes.

Current classroom practice for teaching food technology, in the United Kingdom, was researched and then presented by Marion Rutland and Gwyneth Owen-Jackson (2012) at the PATT26 conference. The presentation was titled, *Current classroom practice in the teaching of food technology: is it fit for purpose in the 21st Century?* and was a junior school curriculum study using a small sample of teachers' schemes of work. Their findings concluded that the students were benefitting from being taught the practical skills of learning how to cook, some nutritional knowledge being taught as well as product development. They further went to describe that there was room for more product design strategies that is similar to industry design. What was disappointing to them was "the lack of evidence in this research to the teaching of existing and new food

technologies, the environmental issues around food or the role of government and food agencies in food matters" (p. 413), so these important aspects could be integrated into future courses.

The early 1997 study by Daulton found the keen family and consumer sciences teachers of America adopted "micro-computers for educational purposes" (p. 56) and fifty percent of teachers with computer access were using them in their classrooms, according to a study by Eyre and Peterat (1990). Daulton (1997) used this research to build upon and found that with time this rate of adoption increased to eighty three percent in the 1992-1993 time period. This followed the adoption-diffusion paradigm which Rogers (1983) proposed due to the difficulty in getting new ideas accepted at a greater pace. Trying to get the rate of adoption of computers in classrooms increased became an interesting prospect. Daulton (1997) found that the adoption rate of micro-computer use by family and consumer sciences teachers "seemed to follow the classic adoption-diffusion pattern of adoption occuring in a social system over time" (p. 57). Although this finding was only for the State of Kentucky, it would be interesting to see if the rate of take up of digital technology use by food and textile teachers in New Zealand reflected the same rate of adoption as the adoption-diffusion theory suggests.

As New Zealand universities and technical institutes develop innovative digital courses in food and textile technology and hospitality courses, FTT teachers have been able to liaise with these institutions to assist with up-to-date learning and developing their own programmes. The Hospitality and Tourism school at both Manukau Institute of Technology and the Auckland University of Technology along with the Massey University food science, technology and nutrition department are building some strong links with schools and their careers, FTT and hospitality teachers. Auckland University of Technology with their Textile and Design lab (TDL) explores technological advances in textiles, eTextiles, and smart textiles. TDL has innovated several digital developments based on their research and development and which they are sharing with industry partners and school students (Ballance, 2016; Rogers, 2012). Secondary students will

be able to access virtual reality tools that can show them how to create patterns with an avatar, or access learning from these tertiary institutions. Tools like virtual reality or a virtual learning environment can enhance student learning (Devlin, Lally, Sclater, & Parussel, 2015; Lau & Lee, 2015).

McGregor (2015) in her last article as Interim Editor for the Journal of Family and Consumer Sciences discussed with other contributors *The Future of Family and Consumer Sciences (FCS) and Home Economics: An International and Intergenerational Vignette Future of FCS*. The contributers discussed the need to include sustainability, protecting the earth for future generations and safe and happy families as part of their teaching programmes.

The pathway to the future may include working with our everyday lives along with global issues using the STEM (Science, Technology, Engineering and Mathematics) subject areas. Being able to include the FCS, food and textile technology or home economics curriculum within the STEM subjects, without losing the focus on these important subject areas, could be a pathway for the future. Increasing the quality of life through everyday experiences and knowledge from a global as well as a local perspective using digital technologies could assist with student understanding and learning which is required to build on the skills they already have and to progress further.

In Foreman's interview with Clark Aldrich (2005), who is recognised as an eLearning expert and author of "Learning by Doing: A comprehensive guide to Simulation, Computer Games and Pedagogy in e-Learning and Other Educational Experiences", Aldrich discusses the future of the education landscape, making the pertinent point that teachers will not be working endlessly to "produce revolutionay content" as we may think. He continues to say in the interview;

> They can nudge. They can implement. They can make case studies. But ultimately, this is a big deal and needs to be treated with the same respect as any other industry … but ultimately it will take a lot of money and a lot of time. (p. 3)

Furthermore the future he envisages will see a shift to more “remote study and self study, where students can drop in on classes in other parts of the world” (p.3), yet thirteen years later, this global learning possibility appears still not to have been implemented in a sustained way in New Zealand. NetNZ and Communities of Online Learning or COOLs (recently part of an Education Amendment Bill in January 2017, as detailed below) are the beginnings of this future type of education.

> Part of the Education Amendment (Update) Bill proposes a legislative framework for online learning, acknowledging that students will access their education through online delivery, with providers from the schooling, tertiary education, and private sectors. Any registered school, tertiary education provider, or a body corporate that has been approved through the accreditation regime, will be able to be a COOL.
>
> Changes related to online learning will come into force by December 31, 2017 at the latest unless by brought into force by Order in Council earlier. (http://www.elearning.tki.org.nz/News/Communities-of-Online-Learning-COOL)

Aldrich (2005) seems to envisage, however, the type of content he posits will need “more integration between learning and doing” (p. 3) which is where the subjects taught by food and textile technology teachers are the ideal platform as they are trained in both practical and theoretical teaching and which are directly related in each subject field.

Like Aldrich and others, educators need to consider the many ramifications that the inclusion of digital technologies will have on not only our own but also the lives of future generations. Neil Selwyn suggests in the chapter he wrote in *Critical Perspectives on Technology and Education* (as cited in Bulfin, Johnson, & Bigum, 2015), there is a need to look critically at all the methods of integrating technology into education.

Consideration of the status of technology in all areas of education including academic research, and the importance of critical analysis which needs to include “social, political, economic and cultural complexities” (p. 248).

Making a difference with innovation and “harnessing the power of technology” (p. 253) needs to be tempered with the critical thinking, much like we are attempting to instil in our students, as we look forward to a future including digital technologies in education and which has the potential to extend student learning.

Chapter 3: METHODOLOGY

3.1. Introduction

The literature review highlighted the need for teachers to include pedagogy with the introduction and use of digital technologies in their classrooms. The use of blended learning has been assisting teachers to integrate and trial different digitally based programmes and applications into their teaching units of work. The time required to do this extra work along with additional professional development to update skills has been a concern of some researchers but Ho & Albion (2010) found overall a positive attitude to the inclusion of ICT, despite some of these barriers. Several different opinions on the integration of digital technologies abound, those who feel the possibility of positive outcomes for students to those who are sceptical. The demand for digital skills are evident, especially since the inclusion of digital technologies into the New Zealand curriculum from junior through to the senior years for school students comes into effect in 2018. These factors impact on the food and textile teachers and they have been integrating digital technologies into their programmes with the aid of models like SAMR and Teaching as Inquiry which were detailed in the literature review.

The methodology used in this study is explained in this chapter. It describes how the participants were approached and outlines the four phases of the research process which was: school consent; survey instrument – teacher questionnaire; teacher interviews, and data analysis. Some justification and explanation for each phase is included. The main research question asked in this study links pedagogy with how food and textile technology teachers are using various digital technologies to enhance teaching and learning with the main question asking: How is the pedagogy of food and textiles technology teachers changing with the introduction of digital technologies?

The supporting questions include:

- What are seen as the most useful digital technology tools by food and textile teachers for modern learning practices?

- What are the approaches to the incorporation of eLearning into New Zealand classrooms and to what extent are they being used in food and textile technology classrooms?
- What are the food and textile teachers' perceptions of current and future eLearning needs of their students?

The ethical procedures and study limitations, along with a short discussion on how results were analysed is included. A summary of the above concludes this section.

3.2. Education research

Today we have a new generation of learners, sometimes referred to as digital natives, who have begun school life with access to advanced ICT and digital technologies. Alongside them are an older generation of teachers in New Zealand schools who did not start their careers with access to Web 2.0 tools and may use traditional methods of instructing students (Adhikari & Parsons, 2012). The integration of new methods of learning using digital technologies and incorporating 'tried and true' traditional teaching methods, which is predominantly teacher led, are being analysed by different researchers and educational agencies so that the best fit for their student population can be sought (Bolstad et al., 2012; Facer, 2011; Wright, 2010). The mixture of different teaching methods combining traditional approaches with eLearning is often called blended learning. The integration of digital technologies into classrooms using blended learning began with the substitution of digital for traditional methods of learning, as seen in the SAMR model. However, it has been posited that adding effective pedagogical strategies for student learning using digital technologies can be a more effective use of this tool (Parsons, 2013; Tucker, 2013).

There appears to be more research regarding technological interventions and incorporating digital technologies in educational core subjects like science, mathematics and English, (Bray & Tangney, 2013; Hennessy, 2006; Hennessy, Ruthven, & Brindley, 2005; Scanlon & Holliman, 2004; Sheehan & Nillas, 2010; Wang, Hsu, Campbell, Coster, & Longhurst,

2014) than in other subject specific areas. Option subjects in senior secondary school for instance food and textiles technology have very little current research and information that investigates best practice for the integration of digital technologies into New Zealand classrooms. This research aims to provide insights into technology teachers of food and textiles current thinking and ideas for the future integration of digital technologies.

Discovering how teachers perceive and use research and what might be the best approach to assisting their needs, the “theory based change” from a literature review of several projects by McLaughlin, Black-Hawkins, and McIntyre (2004), found that researchers need to be able to adapt research to fit how teachers function on a day to day basis, along with making it relevant to their circumstances. This concept has formed the research methodology of this study in which teachers are central to finding the answers to the research questions.

The integration of digital technologies into teaching programmes can be a complex task with many factors influencing the inclusion of Web 2.0 tools and the myriad of different teaching methodologies which digital technology and web based tools allow (Hamilton, Rosenberg, & Akcaoglu, 2016). Teachers can become overwhelmed by this for many reasons including, time constraints, lack of knowledge of ICT integration and confidence in applying different digital technologies. Hennessy et al. (2005), discussed the need for teachers to have ownership of integrating digital technology use along with having successful classroom practices on their own terms. Their findings noted that with ICT integration “English secondary teachers are rising to the challenge which this powerful tool presents. They were found to be generating, trialling and critically reflecting on some new forms of activity, resources, and strategies for mediating ICT supported learning in their classrooms” (p. 187). Looking for these types of pedagogical approaches within food and textile technology teachers and sharing with others their experiences of what they saw as best practice were the guiding principles for this study.

3.3. Research methodology

This is an educational research study where the theoretical paradigm is interpretive. The methods are mainly qualitative along with the technique of sequential design (Cohen, Manion, & Morrison, 2011) of an initial questionnaire to gain some qualitative and quantitative information, followed by semi-structured interviews with individual teachers to gain greater insight in a qualitative manner. Morehouse, in 2011, defined interpretive inquiry as “quantitative, qualitative, and mixed method research that sees humans as agents who act with others in a social and cultural context”, and believes that the reason interpretive inquiry should occur is that “interaction between and among people who are engaged in joint practice are important to education” (Morehouse, 2012, p. 22). Cohen states that the interpretive paradigm is “characterized by a concern for the individual” (Cohen, Manion, & Morrison, 2013, p. 21) where the researcher is trying to get within the person to gain a subjective understanding of their world.

The perceptions of the pedagogical approaches that teachers use across a wide range of food and textile technology classrooms was partially gained from both the questionnaire, which used a combination of open and closed questions followed by a semi-structured interview. The changing and evolving nature of education and necessarily pragmatic nature of teachers made this information best ascertained from the interview process. As a teacher of food and textiles technology the researcher’s knowledge of this field was also useful in the analysis of this data. However, with the reflexive nature of this study where the researcher is also part of the community of participants, the researcher needs to be wary of his or her conduct during the research process (Cohen et al., 2011, p. 225). Occasionally, this could mean understanding the social order of the food and textiles community of teachers with the different interests each holds for the integration of technologies. It is felt that the researcher needs to carefully navigate, with a genuinely objective view, all the differing opinions of this community.

The idea of using the SAMR model developed by Dr Ruben Puentedura, (2006) and also the TPACK framework to gain a deeper understanding of the different elements of technological knowledge, pedagogical knowledge and content knowledge (Koehler & Mishra, 2009) was utilised as the first step for understanding the data. Williams and Gumbo (2011) used the pedagogical content knowledge (PCK) concept to look at New Zealand technology teachers PCK as there are unique pedagogical techniques used by these teachers along with different technology content understanding required by the curriculum when integrating them both. The findings of the complexity of each classroom in this research showed that there were unique differences in each teachers' application of PCK in their teaching.

On research completion it was decided that because of these variations that a thematic approach for the findings would best suit the variety of outcomes and research questions asked. The data analysis, outcomes and conclusions could be partially explained by the SAMR and TPACK models along with other suitable models as this was also a method used by Salavati (2016). The SAMR and TPACK models are known in educational research and are useful tools. As stated by Salavati, they can be used "as a guiding foundation for describing and discussing teachers' adoption and use of digital technologies" (p. 63).

3.4. Data collection methods and research design

Menter, Elliot, Hulme, Lewin & Lowden, (2011) in "*A guide to practitioner research in education*" refer to some teachers' views on educational research as being abstract and removed from their own experiences. They stated that "teachers frequently call for nuanced or 'personalised' research and analyses of data that connect more closely to the experiences of *their* pupils, fellow teachers and local school setting" (p. 229). Using ideas for data collection, from their work along with others, a questionnaire was designed to collect a variety of information and data regarding the participants' backgrounds in teaching secondary school classes along with information regarding their use of digital technologies (Cohen, Manion, & Morrison, 2011; Mutch, 2013; Schwartz-Shea & Yanow, 2011). Choosing

the best methodology to best answer the research question was guiding choices for data collection along with the ease of use for the participant (Mutch, 2013).

This was followed with a further qualitative technique of semi-structured interviews, allowing for a thematic analysis as described by Mutch (2013, p. 164). The data collected by the questionnaire was further investigated and the perceptions of pedagogical approaches that teachers use across a wide field of food and textile technology classrooms were analysed. Using this approach further assisted with the collection of data required to answer the research questions. Background information was gained quickly through the questionnaire and in-depth information from the semi-structured interviews. Student voice, however valuable, cannot replace a teacher's experience and qualifications to teach in this instance, no matter what tools are used, digital or otherwise. However, Lymbury (2017) found student voice was useful at looking at the inclusion of digital technologies in a broad educational sense. Consequently, as expert practitioners but often new to digital technology integration techniques, teachers were the chosen participants. The choice of using a questionnaire along with interviews allowed participants to consider what they wanted to contribute by adding further voice to their answers on the questionnaire.

This analysis was completed using an interpretive methodology which, as argued by Schwartz-Shea & Yanow, (2011) allowed for "the researchers ongoing and evolving learning while in the field" (p. 55) and also allowed flexibility and new knowledge to be acquired. Themes can often be found in the data, which after analysis, can provide interesting and worthwhile insights (Menter et al., 2011, p. 144). This is discussed further in the data collection and analysis chapter below.

3.4.1. The researcher

New technologies have always been an interest of mine. I have worked in many technologically based businesses, starting with the opportunity to design a database for a cafés stock control, and going on to work in software support for a personnel programme, a mobile phone company and then for a digital media company. This company specialised in

advertising using three and a quarter inch floppy discs with digital advertisements. These could be seen on television for example pods at chosen Foodtown supermarkets (Owned by Progressive Enterprises Limited, with their stores currently called Countdown) and BP service stations. These were the precursors of the large outdoor digital screens we see now. All these companies were ahead of their time and finished before the flood of digital technology became popular and ubiquitous.

Following this I became a parent and teacher, then shortly after that the head of the food and textiles department in an urban high school. Being appointed to head the technology faculty a few years later, my background in these technology based companies was very useful for my role as a leader in this subject area. During this time another new technology curriculum was introduced and I began a postgraduate degree to assist my curriculum knowledge in the technology area and to assist the development of my department.

Research into the teaching and learning area of the technology subject area in secondary school is harder to find than say Mathematics or Science (Joyce & Hipkins, 2015, p. 2) and this was a motivation to look deeper into how I could assist and add to this area of study. The combined knowledge of colleagues as they continue to integrate digital technologies in programmes of work and ascertain what challenges and benefits may be involved could be useful to the food and textiles technology subject areas and those who teach in them.

3.4.2. Participants

Food and fabric technology teachers from a variety of New Zealand schools in one city were asked to participate in this study. Sixteen New Zealand secondary schools were approached, to give a broad cross section of different secondary schools. Five Principals gave consent for their teachers to participate in this study. These schools have been named after native New Zealand birds for anonymity i.e. Kokako and Tui. Teachers of food and textiles technology are usually experts in their subject fields due to the specialist nature of the subject, the health and

safety requirements and the subject specific content knowledge required, so the management of the integration of ICT into their classrooms is their domain. These were the teachers that were of particular interest for this study, and after consent was granted from the Principals, either these teachers or the head of the particular departments in each of the schools were approached. The teachers who consented to participate have been named after characters in the Jane Austen novel, Pride and Prejudice to safeguard their anonymity i.e. Caroline, Elizabeth, Jane.

The teacher participants were asked to complete a questionnaire and requested to participate in a one to one semi-structured interview. Of the five schools, ten food and textiles technology teachers agreed to complete the surveys and of those only eight returned completed surveys. This occurred over a period of 12 months from August 2015, when the first Principal was contacted, and August 2016, when the last questionnaire was returned. The interviews were completed in a much shorter time frame.

Of the three teachers who agreed to be interviewed, one had a Bachelor of Arts (Auckland University) and Bachelor of Science (Massey University), the second two who were interviewed both had completed three year Diploma courses in Home Economics, one in Christchurch and the other at the Epsom campus in Auckland (which was a teachers college and is now part of the Auckland University). They both completed extra papers at university one for a degree equivalent course and the other participant an extra-mural degree course.

The first teacher interviewed was Caroline, from Kokako College, who is predominantly a teacher of food technology but has also taught some senior hospitality classes. Next to be interviewed, was Jane, who also is from Kokako College and teaches predominantly in the hospitality and food technology area but has also taught in other subjects in the technology curriculum. Kokako College is a co-educational school that has recently introduced Bring Your Own Device (BYOD) for Year 9 classes with both Apple and Microsoft platforms. Caroline teaches mainly senior Hospitality, but she also has junior technology classes.

Elizabeth, who teaches in a large, single sex girls' school, Tui College, was the last teacher to be interviewed. She is the Head of Department (HOD) food technology and hospitality, and teaches mainly food technology, a few hospitality classes and also a few textiles technology classes.

3.5. Data collection and analysis

Permission and consent was requested for the food and textile teachers participation in a letter emailed to the principals of the schools approached (see Appendix 1) once the proposal had passed the Ethics committee. The information letters were emailed along with a link to the survey/questionnaires to teacher participants after consent had been given by their principals (Appendix 3). Initially names of participants and email addresses were attained by visiting the school websites and/or by email or phone calls once consent has been given by the principal of each school.

Participants were invited to participate in a semi-structured interview for clarification of the survey questionnaire they previously completed (see Appendix 5) and other relevant questions (see Appendix 6). The participants who agreed to an interview were given a consent form to sign for the interview component at the time of the interview (see Appendix 4) along with information regarding the research study. This information was also sent to the participants earlier when organising a suitable time and place to hold the interview that best suited them. They understood that they were under no obligation to do the interview and they could withdraw any time. The following information outlines in detail the four phases of the study that occurred after ethical approval of this research had been sought. These were gaining school consents, survey instrument completion, semi-structured interviews and the analysis of data.

3.5.1. Phase One: School consent

Contacting Schools

The schools chosen were initially searched on the internet and through their web pages contact details along with email address of some possible

participants were obtained. The principal's name was always available, so they were easier to obtain than the head of department (HOD) or head of faculty food/textiles/technology (HOF). Sometimes, with the female principals, deciding whether to put Ms or Mrs, in correspondence, was also considered as there was no wish to offend anyone. A letter of introduction was attached to the email, along with a consent form and sent to the principals of the schools being approached (Appendices 1 & 3). Obtaining email addresses was a little more challenging along with the right procedure for contacting the principals to obtain their consent. It was decided to keep the introduction letter simple so that the process of gaining their consent was easy for them. They were able to reply by return email, if they agreed. The principals who replied affirmatively did so quickly once receiving the request, as did many of those who turned the request down. A large cross section of different schools were approached including state and private, single sex and co-educational schools. After the first email to five schools (on 29/08/15), two principals agreed, one declined and two gave no replies. Another four were sent by email (on 04/09/15) with a further two more declining to participate and two with no replies.

This was not going according to plan as the ratio of schools agreeing was much lower than had been anticipated. It was decided to send emails to some of the teachers the researcher had spoken to initially and get their assistance by discussing it with their departments and possibly following up with their principals. Several schools from the first group did not reply so four new schools (on 07/09/15) were approached by the researcher with one consenting to participate. With the requirement for more participants the researcher approached two more schools after talking to the teachers in charge of food and textile technology departments. Fortunately there was one immediate reply with the principal's consent but no reply from the other school. This was done with careful consideration of timing as the schools were busy with their senior students' internal marking and exam preparation along with preparation for senior prize-giving by the principals.

A few changes were required to gain ethics approval giving Phase One a tight time frame. This meant getting teacher consents during the very busy third term of school before senior students leave in the beginning of term four for external examinations (New Zealand schools have four terms). Therefore, time to send out the questionnaires has been shortened and this meant a shorter time frame for the participating teachers to complete surveys before the end of the school year. The other issue arising from this was interview times could not be organised until the New Year due to the school holidays at the end of December through to January. As schools tend to get several requests for research they need to pick and choose carefully those they would like to take part in. It is with gratitude that I acknowledge those schools and participants who have replied and given consent as their time is so valuable.

3.5.2. Phase Two: Survey instrument - Teacher questionnaire

Teacher participants were sent a letter of introduction (Appendix 2) and survey request by email. Initially it was decided to have an online survey (Appendix 5) but this survey instrument was better sent as an email attachment because it was not very large but had complex grids. Thus this type of questionnaire was thought unsuitable for SurveyMonkey and Google forms which were in their infancy at this time. It also did not give the teachers an option of filling out the questionnaire manually. The time taken to complete Phase 1 and Phase 2, where participants access and complete the initial online survey was thought to take approximately 10-20 minutes.

According to Fowler (1998), “the quality of the resulting data from a survey will be no better than the questions asked” (p. 371). The teacher questionnaires for this survey took considerable time to develop before being added to the Ethics application. Many different forms of the questionnaire and its distribution were considered including using Google documents, sending paper copies, and possibly utilising SurveyMonkey or a similar online dedicated survey application. After reading relevant literature about different methodologies and questionnaire development information, along with looking at the few similar studies in this field, the

survey instrument was developed with the research questions in mind. Some of the most useful questions would be around types of eLearning tools and the ways they were utilised. After background information about the participants was ascertained it was decided that finding out which of the subjects the teachers taught, (i.e. food, textiles technology or hospitality) the year levels and for how long would give a great deal of information in an easy grid format.

With the questions regarding the use of digital technologies, starting ideas or examples were given so that the teachers would know what was being asked and for ease of completion. These examples were chosen from frequently used eLearning tools and at random for variety. The questionnaire ended with a request for the interview and how many years each main subject had been taught along with minor subject areas. This was decided, along with some of the data questions on digital technology use to ensure the questions covered what the teachers wanted to include in the survey.

With the questionnaire's first draft written the researcher needed to test it further and ascertain whether it gathered the required data. It was piloted with a colleague who had a background in market research and her opinion on its clarity and ease of use was sought. After considering her feedback, some changes were made. Once that was done the head of a health department in a large high school, and originally a technology teacher, was asked to complete a trial of the questionnaire and see if there were any minor changes needed. Her classes write and work with many surveys and questionnaires for their health related assignments and she had a good understanding of what was required from a questionnaire for different situations including those sent to teachers. Once that was completed and it was added to the Ethics Application along with the other appendices including the semi-structured interview questions.

A great deal of care was given to the questions that were asked and how they were worded so the teacher participants did not feel there was an expectation that they used any of the eLearning tools mentioned. The questions were varied, as were the type of answers that could be given,

for example, some required a written comment, others required a yes/no or a tick box or grid. These questions focused on the teachers' details and the classes they taught, how long they had taught in each subject area, the different kinds of eLearning applications they used and what they used them for. There were some questions asked that were precursors to other questions and teachers were given the choice to expand on their answers.

The principals' consent for their schools to participate in the research was sought and when this was confirmed, the schools were phoned in order to get the email addresses of the head of the food and fabric technology faculties (HOFs). Everyone spoken to was very kind and all the details required were obtained. Initial requests for consent and questionnaire completion were sent to the heads of departments (HODs) along with a request for the names and email addresses of their staff. Questionnaires along with a copy of their principal's school consent were sent by email for their information and completion. Similar emails were sent to the staff in their departments once the HOD/HOF had given approval.

It did not all go smoothly or to plan and with the time of year being so busy, emails were sent intermittently as schools and teachers replied, and when the researcher was able to find time as a full-time teacher and part-time researcher. Some teachers did not reply, and polite, gentle reminders and further requests were sent when that was felt to be appropriate. There was much time spent considering the most appropriate time to contact teachers so as to cause them as little inconvenience as possible.

Initially, six completed questionnaires from three different schools were received. By the completion of the research there were eight completed questionnaires from four different schools. The fifth school where the principal gave consent, the technology staff did not reply to emails and did not complete any questionnaires. The final school principal consent was given in May 2016 and collection of questionnaires completed by August 2016.

3.5.3. Phase Three: Teacher interviews

The participants who had agreed in Question 12, to a semi-structured 30-40 minute interview were contacted and asked whether they would be willing to meet with the researcher for a 30-40 minute interview, at a time convenient to them, in order to expand on the questionnaire. It had been originally been anticipated that these interview sessions would take approximately 30–40 minutes and there would be up to ten participants. Interview participants were sent transcripts of their interviews for checking and amending which would take approximately the same amount of time again. A total of an hour to an hour and a half for those teachers involved in all aspects of the research – i.e. completing the survey, the interview and checking the transcript.

At the interview stage, which was behind schedule by several months, interviews which were supposed to be completed and transcribed had not been started due to getting Ethics Approval later than anticipated. We re-contacted the Ethics committee to confirm that it would be still valid to continue with the research component as there were some anxious times due to other changes needing to be cleared with them. We were very pleased to find we were given approval to continue.

Interviewing individuals for research needs to be fully considered and after checking the questionnaires for the interview consents, I found that there were three interviews to complete from teachers from two different schools. Each participant was emailed with thanks and a request for a suitable place and time to meet. The semi-structured interview documents, including the questions to be asked, consent form, and further information regarding the study were also attached for their information and hard copies taken to the interview for them. Participants were asked if it was okay to have the interview recorded on a digital MP3 recording device and it was explained that the final transcripts of their interviews would be sent to them for checking and amending. The transcripts approval by participants was completed by September, 2016 however one last interview was being sought during this time. They were also asked where they would like to be interviewed so that they felt comfortable and they

mostly chose their office at work with one participant choosing a private residence.

The choice for using the semi-structured interviews was guided by Forsey, (2010) in the chapter: *Interviewing Individuals* and his discussion of *Starting with the end in mind,* (cited in Delamont, 2012, pp. 364-376) from Delamont's *Handbook of Qualitative Research*. Looking at the reasons for using one of the most used methods of data collection in research i.e., interviews, Forsey says richer data can be gained than with a survey. Interviews make more sense in our current society as they can contribute:

> tangible, 'work-withable' data in a field of endeavour that oft times feel abstract, difficult to pin down. More positively, or at least less pragmatically, the research interview provides an opportunity for creating and capturing insights of a depth and level of focus rarely achieved through surveys, observational studies, or the majority of casual conversations held with fellow human beings. We interview to find out what we do not and cannot know otherwise. And we record what we hear in order to systematically process the data and better understand and analyse the insights shared through the dialogue (p. 364).

Once the interviews were completed, each one recorded along with written notes, the interviews were transcribed. The final transcripts were sent to the participants for their approval. There were no alterations to the original transcripts which were sent to the teachers. Their only comment was how long, in content, they thought they were. The data was transcribed by the researcher and as Forsey described, she found the shared insights, understanding and analysis was made easier by using this method.

3.5.4. Phase Four: Data analysis

Data analysis is dependent on the questions asked by the research. Initial analysis was completed manually from the questionnaire and this gave initial findings but did not look deeply into the relationship of the data as a whole. The next system was to look at each question in the questionnaire in relation to the other survey answers and collate them. Although this

allowed for some further insights it was still not answering the research questions satisfactorily. The surveys were put aside as the interviews were read and re-read. Themes started to appear and needed coding, so although there are only a few interviews, three in total, nVivo was considered as the time constraints of the practitioner researcher became more evident. As the University was unable to load the nVivo programme on to the researcher's computer, and working from a distance, this was put to one side.

The programme QDA Miner Lite, a free and simple to use programme for qualitative data analysis became apparent in a Google search. After a quick trial, the ease of use meant that this was the most suitable digital programme to use. The initial coding is attached in the Appendices (Appendix 7). The questionnaire and interview data began to give up more information and related to the research questions more clearly. The following chapter discusses further the analysis of data from the teacher questionnaire and teacher interviews.

Results analysis – teacher questionnaire and semi structured interview
The analysis of the survey, a questionnaire sent by email to the participants, was completed manually first, due to the small number of respondents. Later some results from the semi-structured interviews were digitally analysed using QDA Miner Lite and Microsoft Excel to develop graphs and to look for any other alternative viewpoints. All but one of the teachers responded online and used the emailed form to reply.

3.6. Issues of trustworthiness

The complexity of human behaviour can drive the qualitative researcher to try and better understand what is behind this behaviour and human experience, how 'people construct meaning and to describe what these meanings are (Bogdan & Biklen, 2007, p. 43). The promotion of "validity and reliability in qualitative research" (Mutch, 2013, p. 209) is an important component and Mutch uses Merriam's (2009), list to show methods to illustrate this for instance; triangulation, member checks, adequate engagement in data collection, the researcher's position or reflexivity, peer

review/examination, audit trail, rich, thick descriptions and maximum variation.

Trustworthiness of data is a quality that is necessary in educational research. With qualitative data, according to Cohen, Manion and Morrison (2007) “validity might be addressed through the honesty, depth, richness and scope of the data achieved” (p. 133). They go further to explain that because “the subjectivity of respondents, their opinions, attitudes and perspectives together contribute to a degree of bias” (p. 133).

Clarity and connections that can inform teachers and educators need to be valid and reliable for it to be workable in the classroom. Sinnema & Aitken (2014) discuss how teachers use and adapt data from research for their Teaching as Inquiry process. The importance of accuracy of research findings for some pressing issues in education is essential. It is also important to realise that the data can change depending on environment, individuals and groups of people along with other variables over time (pp 147-149).

In this educational research study, choosing to use a questionnaire or survey along with an interview of participants could allow for transparency of data collection with an audit trail, if required for the data collected (Mutch, 2013, pp. 209-210). Where there have were similar responses from participants an additional connection could be ascertained. The questionnaires used both closed and open questions where participants could give further clarification where required. With the interviews, written notes were taken, along with recordings that were transcribed and checked with the participants for approval of accuracy.

3.7. Ethical considerations

The ethical approval was applied for under the University Application for approval under the Ethical conduct in Human Research and Related Activities Regulations. The covering letter to the School Principals, Teachers, Teacher Survey Questionnaire and Interview questions were attached. Approval was gained in July 2015 after revisions were made.

Procedures outlined in the approved Ethics Application were used to contact schools' and collect data. In regards to the first point of contact, the school principals, researching the schools and the names of the principals were required so that they could be contacted with personalised letters and emails. These were sent along with personalised consent forms for that school attached. These could be emailed by return for ease of use by busy principals' and their staff. Making the consent process as easy as possible for all concerned was an important consideration. Access to participants was gained by requesting email addresses of staff in the learning area or from those who are in regular contact with the researcher. Consent forms for the interviews were gained before the interview had begun and during the explanation time.

Confidentiality has been protected with the use of pseudonyms for participants and schools. All consents and letters prior to personalisation including consents were attached to the Ethics Application along with the questionnaire and semi-structured interview sheets that were shared with the participants.

3.8. Limitations of the study

Food and textiles technology teachers were contacted to complete the questionnaire and the interview about whether or not they were changing their pedagogy with the introduction of digital technologies into the classroom. A number of related questions were also included. The outcomes and analysis discussed in this study relate to the few schools and teachers who took part and are not reflective of any other educators.

All the schools approached were from one city but of varying compositions including co-educational and single-sexed schools, which were either private or state schools and with varying decile ratings. Decile ratings are used by the New Zealand government to assist funding for state and state-integrated schools. They indicate whether the majority of students attending the school come from privileged backgrounds or where the parent population often have a lower income and socio-economic background.

Seventy five percent of teacher respondents came mainly from schools of high socio-economic backgrounds with varying compositions of co-educational and single sexed schools. Twenty five percent of the respondents were from a lower socio-economic, co-educational high school. A larger number of teacher respondents from a greater variety and spread throughout the country of different schools would give a better indication of digital technology use for food and textiles technology in New Zealand high schools.

The researcher as a member of the participant community and a working teacher in the area of food and textiles technology could be perceived as a limitation due to any preconceived ideas on the subject area however an empathy with the subject matter may also be an advantage.

The terminology used to describe various components of information and communication technologies, digital technologies and eLearning has been used within research with some different understandings and values attached to them. There may be occasion in this research where the use of the terminology has been used where the meaning intended by the quoted research may have a different meaning. This could be due to the era in which the research was completed as the use of digital language and eLearning in Modern Learning Practice (MLP) may have changed from what was originally intended.

3.9. Summary

Following the University of Waikato ethical approval application, the study was completed following the process outlined in this. There were fewer participants than were anticipated but due to the time frame the ability to go through the long process to gain more was not possible more than once. There was enough rich data to analyse and the findings are considered in the following chapter.

3.10 Terminology used in the questionnaire

Learning Management System - This is described by the Ministry of Education as a software product for online learning in schools that can be

used to organise and deliver information or lessons. The LMS could be regarded as the schools central digital hub for curriculum and pedagogy (New Zealand Ministry of Education, n.d.). It can be further explained as, “A software application or Web-based technology used to plan, implement, and assess a specific learning process“, where an instructor is able to “create and deliver content, monitor student participation, and assess student performance” (Clayton & Elliott, 2007, p. 124). In this instance, it is also called an Online Learning Environment (OLE).

Other terminology explanations used here can be found in the Educational Review Office (ERO) Modern New Zealand Learning Practice glossary available from: the ERO website. Digital applications mentioned in the questionnaire can be accessed through the internet.

Chapter 4: FINDINGS – TEACHER SURVEY AND INTERVIEW RESULTS

4.1. Introduction

In chapter 3, the research methodology was explained along with information regarding the instruments used and the data analysis options available for use that best reflect the results of the data that was collected.

This section outlines the participating teachers' responses to a questionnaire (Appendix 5) and a follow-up semi-structured interview (Appendix 6). This is organised in terms of three key themes. Theme One, the digital technology tools used in the classroom by the participants. Theme Two, teaching approaches used when incorporating digital technologies into the classroom, and Theme Three, the participants' perceptions of the current and future eLearning needs of their students. Food and textiles technology along with hospitality subjects (within the service industries in the vocational pathways framework) use similar digital tools and applications as well as teaching approaches. The participants' views of future eLearning needs and how these are currently being trialled in classrooms also emerged as a developing area of interest during the teacher interviews.

The initial survey was completed by seven female teachers and one male teacher with 50% of these teachers having taught for nine years or fewer, and the other 50% of teachers surveyed having taught between 10 and 37 years with four years teaching being the minimum experience when the survey was completed in 2016. There is a wealth of experience in this teaching area and this variety of different lengths of service means that those with fewer years can learn from the experience of others. Of the eight respondents, the combination of subjects taught were shown as six teachers in food technology, five teachers in hospitality and five teachers taught textiles technology. Most taught a combination of subjects but only two teachers had taught textiles technology exclusively during their careers to date.

4.2. Theme One: The digital technologies in food and textile technology classrooms.

4.2.1. Results from the initial questionnaire.

Teachers' use of school learning management systems (LMS).
The internal school network for student online education is called a Learning Management System (LMS) and there are various platforms available for school use (New Zealand Ministry of Education, 2018). Schools use integrated web applications or online learning environments (OLE) like ULTRANET or MOODLE and more recently the GOOGLE suite of learning tools like Google Classroom. In response to Question 3 of the initial questionnaire, the teachers indicated their use of these platforms and how often their students used them. This is summarised in the following chart:

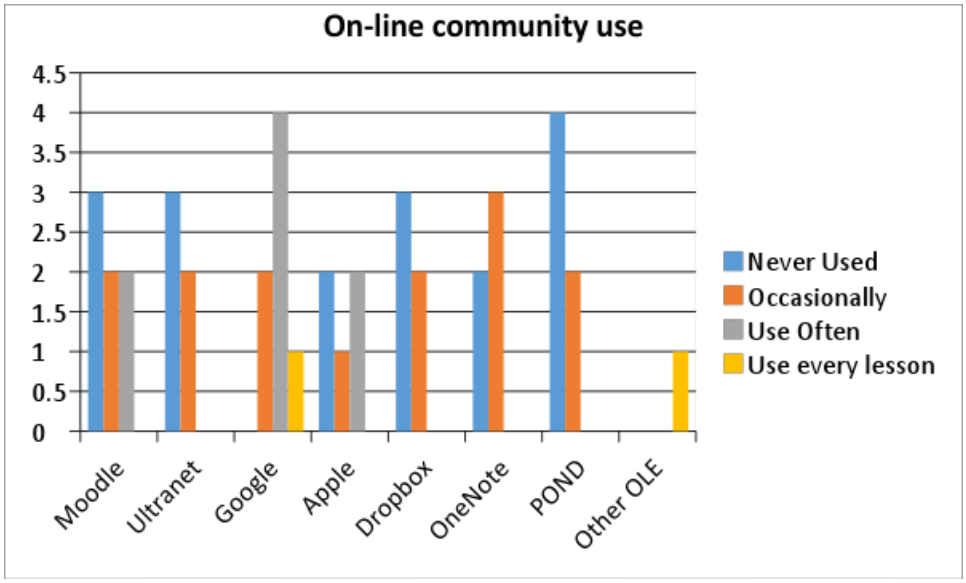

Figure 11. Number of teachers whose students use a LMS and/or cloud based platforms.

As can be seen in Figure 11, teachers used one or several of the Learning Management Systems regularly with five teachers using the Google suite most frequently, followed by Moodle and then Apple. All the teachers surveyed used the LMS in their schools for course information and YouTube clips.

Seven of the eight teachers used the LMS for course details, year plans, pictures or images and powerpoints. Six teachers also used it for worksheets and links to educational sites eg NZQA. The next most used application was for creating presentations (four teachers) followed by three teachers using links to online resources e.g. CreativeBug. Two teachers use Facebook and OneNote and individual teachers use forum, screencast tools, Prezi, a blog, wordle or other word cloud tools and a wiki. These details of what the teachers have used on their LMS were gathered in response to Question 4 in the initial survey, i.e. What information and activities have you used on your LMS/Cloud to teach food and textiles technology? The collated answers are shown here in Table 4 and each colour tick box denotes individual responses with each colour belonging to one participant and given at random.

Table 4.

Information and activities teachers have used on their school LMS/Cloud to teach food and textiles technology.

Information &/or Activities	Please tick appropriate box/boxes ☑	Information &/or Activities	Please tick appropriate box/boxes ☑	Information &/or Activities	Please tick appropriate box/boxes ☑
Course details	☑☑☑☑☑☑☑	Forum	☑	Presentation	☑☑☑☑
Year-plan	☑☑☑☑☑☑☑	YouTube clips	☑☑☑☑☑☑☑	Powerpoint	☑☑☑☑☑☑☑
Course information	☑☑☑☑☑☑	Wordle or other word cloud tool	☑	ScreenCast tool	☑
Pictures or Images	☑☑☑☑☑☑☑	OneNote	☑☑	Prezi	☑
Worksheets	☑	Facebook	☑	Photoshop	

	☑ ☑ ☑ ☑ ☑		☑		
Video/DVD	☑ ☑ ☑ ☑	Blog	☑	Podcasts	
Links to educational sites eg NZQA	☑ ☑ ☑ ☑ ☑ ☑	Wiki	☑	Links to online resources eg CreativeBug	☑ ☑ ☑

Please add any other activities you use on the LMS/Cloud here:

Set up Google website. Links to Pinterest boards

The teachers were also asked to list three or more of the most useful applications and what they used them for. Table 5, below outlines what each of the teachers used the application for. A starter example at the top of the table was given to help the teachers understand the question better.

Table 5.

Summary of responses to most useful application and uses.

Application	Students use for …
Eg. Trello, Edmodo, Google docs	Sharing information in groups online
Eg. eBooks, live-binders, wikispaces	Students suggested these to use as eLearning tools for holding their own information, portfolios etc.
Google drive	Shared folders, shared docs, uploading files and photos
Wix/Prezzi/Weebly	Students use to display learning
Kamar	Used for attendance, result recording etc
Elearn/moodle	Sharing all info and useful links for courses and projects
Google docs	Sharing/editing work
+Pond	Gathering useful resources, connecting with other teachers
Google docs	
Google Drive/Docs	Submitting, sharing and marking work, group collaboration, surveys
Trello	Planning, group collaboration
Padlet	Presentations
Google	for research
YouTube	for how-to videos for practical cookery
Powerpoint	for one research assignment to show to the class
Google docs	Sharing group projects wth each other and teacher
Google presentation	Reporting back too class

Table 5, shows the list of most useful applications used by each participant teacher and how they and their students used them. The table is a summary of the teacher responses to this question and the different colours are each individual participant responses. The colours were allocated at random. This was asked in Question 5 of the initial questionnaire and adds further details to what was asked in Question 4. All the teacher participants used Google drive and mentioned many of the applications available. For example Google (search engine) for research and Google documents for sharing group projects, and Trello for organising information collaboratively. The teachers stated that they were able to upload files and photos along with using the presentation and survey functions. Presentation programmes or applications were also mentioned by four participants such as Powerpoint to show to the class, Padlet for presentations, Google presentations for reporting back to class and Wix, Prezzi and Weebly for students use to display learning as shown in Table 5. These different programmes and applications were not always used in conjunction with the school LMS and could be initiated with or without that particular further link.

Kamar, which is also mentioned in Table 5, is a Student Management System (SMS) which keeps records of student information and can include their personal details, timetables and reporting information. Some of this can be accessed remotely (Ministry of Education, 2017b). The teachers reported that there are facilities within the software that can be used for attendance and recording student assessment results. They can also access daily notices, school event information, class rolls, set relief, book school equipment and facilities, generate global data and other teacher information. Some of this can also be made available online to parents. Other teacher applications that were found to be useful included POND where teachers can share their resources, units of work and other information with each other, and also YouTube for showing students how to carry out specific techniques in their subject area.

4.2.2. Teacher interview results analysis for Theme One

This section discusses what the most useful digital tools and programmes and/or applications are for the food and textile technology and hospitality teachers interviewed in this study. Teachers of food and textiles technology require specialised knowledge to teach in this subject area as they are required to have the skills to both cook and sew along with knowledge of the technology and home economics curriculums. Hospitality teachers may teach within the technology departments in schools but do not need to teach to the technology curriculum. This means that design is generally not part of their programme.

The participants in this study were asked in Question 2c of their interviews if there was any ICT training included in their teacher training. All the three teachers reported to have had a minimal amount or no training in digital technologies Elizabeth using ICT for filming a technique (Batik) for playing back on a projector, Caroline using an ePortfolio in her studies, without any training and has not used this since and Jane did not have any training at all. In this era it is important for teachers to be able to use these digital tools, particularly at senior levels (Years 11 to 13) where the students may be assessed using a digital medium in the National Certificate of Educational Achievement external examinations. This method of assessment is becoming increasingly likely (New Zealand Qualifications Authority, 2017). However, all the teacher participants can be seen as having the skills described in the TPACK model, perhaps some to a more or lesser degree depending on years of service or greater interest in various aspects of their subject. The extra time and professional development required to gain the skills to integrate digital technologies effectively in to their classrooms has been a common discussion in these interviews.

To find the most useful digital tools Jane, one of the first teachers to participate in the research, explained that she had attended a workshop at a local university looking at the current trends in the use of digital

technologies in the service industry. This had been very valuable and she reported that she found the young staff working within this sector used digital technologies mainly to connect with other members of staff. She said, *"so within their employees there they'll have a Facebook page, they try and make them feel sort of like, work like a big family, they put events on…".*

Her most successful eLearning strategies were based on inquiry learning, using a variety of programmes suited to the task the students chose and the most enthusiasm came from the movie making task set for one of the junior classes she taught. She found that they taught each other different functions within the programmes they were using, and also developed further knowledge with the assistance of another teacher, who shared the same class. For the senior classes Jane found YouTube was great for demonstrating techniques and recipes. She also used Clickview, which schools can purchase and which gives them access to videos on topics related to the courses they are teaching along with the teaching and learning materials associated with these. Jane found this was able to be accessed by both the teacher and the student, anywhere, anytime. Her students were able to watch at their own pace and answer questions online or on paper, whichever they preferred. She explained that the videos were also specific to the food technology or hospitality topic being taught.

Jane found that ServiceIQ, the supplier for Hospitality workbooks and trainer guides along with other services to both industry and schools, also provided some digital resources. These include Tutor Assessment Guides (TAG) for each section of work, powerpoints and digital answers, QR codes, and with more digital tools becoming available in the future. Jane found digital trainer guides to be helpful with the English as Second Language (ESOL) learners as they can be shown on the data projection screen when the students are marking their work however they are not available for all the units she taught. The advantage is that students can do this at their own pace and get to see correct answers. Jane also spoke

about the eLearning and digital strategies she uses in her hospitality courses, and said,

> *Well, I am guided by what is in the industry courses so that would be helpful for your 12, ah, year 13, they have got answers provided for part of the bookwork … but a lot of it is research as well, so they use their devices for researching, in year 13, a lot, a lot of self-paced learning, so they are researching menus and using terminology and even practical skills like making sauces. But the kids are a bit limited according to the device they have but sometimes they will go to the computers in the tech lab.*

Jane goes on to comment that the students are limited by the types of devices they have and their access to computers available in the school. She commented that students are more excited by eLearning and it is important to ensure that it interests them instead of the teacher spending too much time talking. She says, *"the kids are discovering things on their own, based around what you are trying to teach them".* The availability of relevant information online is of benefit to her students and Jane felt with eLearning tasks, *"it's just that you can do so much and show so much more"*.

Caroline, the first teacher interviewed, has also taught a number of hospitality classes but predominantly is a teacher of food technology and works at the same school as Jane. Caroline discussed how she used the schools Learning Management System (LMS) to initially interest students. She uses the assignment function on *(XX) Net* and she is able to give instant feedback to students when they are working online, which she likes. She went on to explain:

> *And often I will get them to do something in class on, um on a Google doc as they are doing it so I can give them* [the students] *feedback in the class and I think it is a good way to keep a track, make sure everybody is working as well, if you say "I want you to share it with me as you are doing it", then it does bring everybody in and you can see who is working at what pace and who needs help.*

I think the students like it as well the feedback so I do like that. That would be the thing I use the most.

Caroline felt that the instant feedback that can be given while a student is working in class is very valuable and the shared documents allow the teacher to see if everyone is on-task. Also she can see if any assistance is required and believes this process allows for good teaching and student learning.

Elizabeth, who teaches in a large girls-only school, was the final teacher participating in the interviews. She reported that she also uses Google classroom, especially with junior classes, to set up all her class folders and for students to share their work from Google documents. She uploads these into their class folders. Elizabeth commented further on her use of her schools LMS, (XX)Learn;

Yeah so we do use (XX)Learn, we just use (XX)Learn mainly for just setting up the framework for what our courses are … and our static resources … and then we use google, Google drive, docs … presentation, all of those things … for more dynamic things … and for interactive … but our yearly courses like if our students want to look up, 'Oh what do you do in year 10?' it will be on (XX)Learn.

Elizabeth also explained that her use of digital technologies had been an evolving thing which began when she was involved in an ICT contract with the government and had three years of quite intensive upgrading of her ICT skills. Now a number of years on, Elizabeth says she uses YouTube clips, links to different sites, and the Google suite, and with the different pedagogical theories and advancements she has learnt from the professional development courses provided at her school. She can choose and update her teaching and learning methods as she learns new or different ways to use digital tools and strategies.

4.3. Theme Two: The teaching approaches to the incorporation of digital technologies in Food and Textile technology classrooms.

This section describes how the teachers incorporate digital technologies into their programmes. The initial indication is that incorporating digital technologies, the digital tools and eLearning strategies have been a natural progression in the teaching process of food and textile technology. Each of the teachers' surveyed and interviewed used digital tools such as the Google suite alongside their school LMS.

4.3.1. Results from the initial questionnaire.

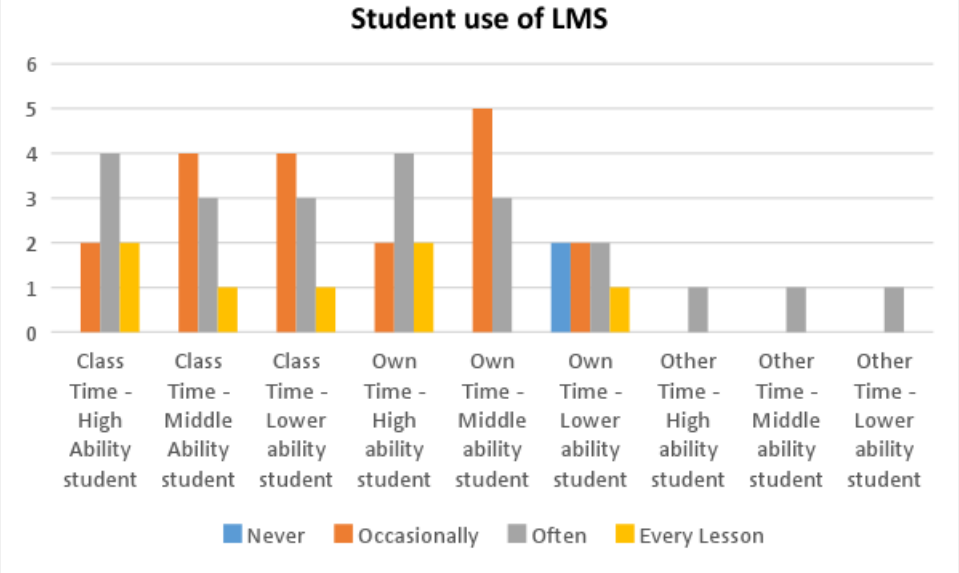

Figure 12. Teacher responses to student use of LMS.

Baseline data is an important component for deciding what requirements are needed for teaching and learning especially for teachers to differentiate their courses for mixed ability classes. Part of this information is gathered using the teacher's knowledge of how students use digital technologies and LMS. Question 6 asked the teacher participants about the student use of the LMS to get an understanding of how often students used it. The findings (shown in Figure 12 above) were varied for each individual teacher and their schools with four teachers who found the high ability students were using it often during their own time but only two teachers finding these students using the LMS every lesson in class. The

most number of teachers (five) found that their middle ability students were using the LMS occasionally in the student's own time. There would be a variety of reasons for how often students use eLearning including access.

Student Bring Your Own Device (BYOD) use

Many New Zealand schools have been introducing a Bring Your Own Device policy into their schools. Some schools allow different types of devices and others may choose to use only one kind of device e.g. Apple ipads. Question 7, in the initial questionnaire asked: What classroom activities do your students use their Bring Your Own Devices for? Five of the participants reported that the majority of BYOD device use was for research five, with one school's senior students mostly using their phones as many students did not own devices in this decile two school. One respondent said that her students used their smart phones for photographing evidence. Two respondents reported other uses which included creating presentations, writing documents, taking photographs, and one respondent for group work, making videos, emailing stakeholders, creating online surveys and questionnaires, submitting work for marking, using Trello to plan, using the Google suite of documents, forms, along with the drawings function, collecting evidence, communicating and consulting with a range of people (teachers/stakeholders), making video tutorials, for recording information, and print designs.

Models for assisting teacher eLearning integration

Question 8, asked whether the Substitution, Augmentation, Modification and Redefinition (SAMR) model and Teaching as Inquiry (TAI) model, were utilised to assist teachers integrating eLearning into their units of work and teaching programmes. The eight participants surveyed did not use SAMR to assist with programme development. They reported that it is best used as a tool to see how the eLearning has been integrated much like the TPACK model.

Teacher links with pedagogy using eLearning

Question 9, which asks 'How did you link the eLearning tasks to your teaching and the students' learning?' showed that the most frequently

used model by teachers to assist with the integration of digital technologies in their teaching and learning was predominantly the Teaching as Inquiry model. The TAI model was the most preferred model by four of the participants using it. Elizabeth said that with the Teaching as Inquiry model “yeah done quite a bit of that” in her interview.

Teachers most useful ICT & DT tools for educational outcomes

Every teacher surveyed used eLearning tools in their teaching programmes. Question 10, in the original Questionnaire asked – “What software or Apps do you use and for what purpose?” Table 6, below is a summary of the teacher responses to this question and reflects every response given, including the hyphens (-) and tick boxes (☑).

Table 6.

Summary of actual responses to software or applications use and for what purpose.

Windows based

	Year level/s	Purpose
Microsoft Office	All Y9 to 13 - All	Documents, Presentations, Spreadsheets Assessment, reading resources As a back up to google when wifi down
Word	All All ☑ Y9 to 13 All - Y10 up All	Reports and research Documents Learning – information sharing Assessment, reading resources Assignments Recording information As a back up to google when wifi down
Excel	All Y9 to 13 - All	Spreadsheets Marking and grading As a back up to google when wifi down
Powerpoint	All All ☑ Y9 to 13 13 All	Presentations Presentations Presentation Research assignment, nutrition – to show class As a back up to google when wifi down
Camera/Photo	All All ☑ Y9 to 13 All 12 All	Evidence gathering and presentations Photographing food, recipes Evidence gathering Evidence gathering Photograph meals Recording evidence
Publisher	All	Producing information leaflets

	- Juniors	 Only for posters etc
Photoshop	None ☑ Y9 to 13 - Y11 up All	 Evidence gathering Print development Various uses
Khan Academy	None - ?	 ?
Scan and Cut Software	`9-13 None - Y11 up	As templates Fabric decoration We have a machine but not used in food yet
Embroidery machine software	It's out of date None n/a	 n/a
Other software:		

Apple based (iphone or ipad or MacBook)

	Year level/s	Purpose
Camera/Photo	9-13 All Y9 - 13 All 12/13 All levels All	For taking own evidence in project work Photographing food, recipes Evidence Evidence gathering Take photos ie. Meal prac. products Photograph evidence Recording evidence
Camera	9-13 All Y9 - 13 All	For taking own evidence in project work Photographing food, students at work, recipes Evidence Recording evidence
Pages	None Y9 - 13 Y10 up All	 Assessment, reading resources Record information If don't have work and wifi is down
Numbers	None Y9 – 13 All	 Marking and grading
Edmodo	None ?	
Other Apps:		
Filemaker Go	Y13	Assessment conjunction with Manukau Tec

Cloud based (e.g. google email, drive)

	Year level/s	Purpose
Google Chrome ……	All Y9 to 13 All - All All	Internet access Researching Research Research etc.
Google Drive	All Y9 to 13 All -	Sharing documents, presentations, marking, surveys Back up Sharing documents

	All All	Sharing resources/work Storage of all documents etc
Google Classroom	9-13 None Y9 to 13 9 - All	For student assignment requirements. Feedback on student work Messaging and email Assessment, announcement Tried once with a class for feedback Shared teacher/student pages
Apple Cloud	None - Unknown	 -
OneNote	Personal All Y9 to 13 - Teacher	Appraisal Information sharing Evidence gathering -
Skype	None - -	 -
TechLink	11-13 Personal 9 - Teacher	Assessment exemplars and vocational pathway info. checking standards requirements. Research Research -
Dropbox	None 11 - Seniors	 Unsuccessful with this Handing in assignments/assessments
POND	Personal - -	Research, Collaboration with other teachers -
Other cloud based apps:	-	
Gmail	All	Student/teacher communication and class group/teacher communication

The outcome of this question showed that each individual teacher participant used different eLearning tools, some using the same application and others using digital tools in a different way or for their own purpose, for example with appraisal. The variety of uses and tools that they used show that food and textile technology teachers along with hospitality teachers are using various eLearning tools regularly with their classes. They are able to consider relevant applications and uses which support their students' learning as well as using them for personal reasons.

4.3.2. Teacher interview results analysis for Theme Two.

Caroline, has completed some professional studies in ICT at school and has had in depth professional development that explored Teaching as Inquiry. Caroline stated that she likes using that method for developing programmes and units of work. She has used it as part of the school's appraisal process and explained, *"Yes I do find it quite good to use and it's good to measure the results against, and it is quite good for goal setting and for evaluating what you do and yeah I think it is quite helpful".* Elizabeth also discussed how she had attended a number of professional development workshops especially those that focused on Teaching as Inquiry.

Universal Design for Learning (UDL) was also mentioned by Elizabeth as a good model for designing strategies for student learning tasks. Teaching as Inquiry, which was asked about in the questionnaire, was what all the interviewed teachers used for programme development. Elizabeth spoke about using Google classroom with her junior classes and she manages their class folders. Caroline described the differences between a number of eLearning strategies she would choose and went on to explain, *"Kahoots, I use them quite a lot, usually to introduce a topic or to find out … just to check prior knowledge … to get interest, the students love them so".* Other tools she used regularly were the school's Learning Management System (XX) Net and the Google documents in Google drive.

Jane was happy to admit, especially in her junior classes that, *"the kids know more than you do and what they don't know they'll learn from the others that do know. So it is very much sharing resources and working in groups"*. She found that the junior students were sharing their resources and working together in groups to complete tasks. She said she felt confident with the junior classes and teaching digital technologies with them, especially with inquiry learning based topics. Caroline also said students found it easier to collaborate in an online environment and she said, *"I think it is good for them to collaborate, to work on things together, I*

think is really good". It especially works well when there is a student absent. The group can still complete their tasks and as she commented further *"that person who is away can also access it, if they want".*

Another influence on the teachers' approach was the different kinds of devices available and the myriad of devices that students bring to the BYOD schools. The data shows that these often consisted of devices using different operating systems for instance Microsoft Windows, but also from varying manufacturers for example, Hewlett Packard, Apple, Chrome books and others. Jane also felt the senior students in her school were limited by only having their mobile phones, and this restricted how she could use eLearning in her senior hospitality programmes.

Caroline reported on introducing a course which, while using the student's devices, still provided details in a workbook. These were shared for the purpose of this study and can be seen in Appendix 7 - The Chef's Hat Design Brief was a part of this workbook. She explained, *"So the intention was to introduce more eLearning into it, to get the students to use their devices more and to use the paper content less, so to build ICT into the course was the intention".* She found this blended learning technique suited her at this time and she stated that, *"it is quite good that you can keep refining it… because we have a new class every 13 weeks… so you don't have to wait a whole year to change your programme you can change it for each class and just tweak things and make small changes as you see fit".* She considered that the programme allowed for student choice in the type of presentation they used so the varying kinds of devices were not an issue.

Elizabeth used digital technology through her school's LMS, (XX)Learn and in response to interview Question 6, How do you decide which eLearning strategies or tools to use?, she said, *"the whole Google suite of things … so really it is whatever tool and strategy that suits the information that we are trying to teach and the type of students we are teaching, we can just match up what is the best tool for the job really".* She continued to talk about using what the school provided in the way of eLearning tools,

looking at what guidance was provided and the strategies the teachers had for their programme development. She felt it was important to also consider the type of students being taught. She agreed that the school used the Teaching as Inquiry model as indicated in her survey and they also had implemented a BYOD programme early so now the whole school, at all year levels, was on-board. Both Caroline and Elizabeth mentioned that their schools still have suites of computer labs or loan banks. Elizabeth went on further and explained that *"(students have) a bank of … netbooks that they can loan, and we still have computer suites because there is specialist software, especially in like music and art, um, you know, technology graphics etc. … they're loaded with those".*

Elizabeth and Caroline also discussed the other tools that can be used for eLearning including 3D printers, embroidery machines, scan and cut printers and laser cutters. They both agreed that although many prototyping tools were available at their schools, the difficulty in getting access to them was an issue. This was particularly due to the number of students wanting to use them, whether or not they were working, or if a technician was available to give advice or service any broken machines. Allocating time to teach skills of how to use the equipment safely was also limited. Elizabeth indicated that she had ideas about how she would like to use the tools that were available in her department, but has not used them to date. Her school's Graphics and Design department uses 3D printers but she said, *"I haven't personally used it for anything I was trying to make a little, a year or so ago, a little stamp, you know … something you could stamp onto a biscuit dough. Yeah, didn't quite get there with it but, yeah".* She intended to keep working on that idea and explore it further as there was a context that she wanted to experiment with and which would involve designing a biscuit with the school symbol or one with the name of the college on it.

Caroline also echoed this sense of eLearning as a work in progress. Some of the ideas she had for using digital equipment in the food technology course, she explained here;

Caroline: I intended to use the 3D printer but it was broken for ahhh, for the time I wanted to use it. We were told when we bought it that you could use chocolate in it but then when I came to learn how to use it with the chocolate in it apparently you couldn't! And then when I changed my programme to using the m plastic, or whatever it is, um, it was broken, so I eliminated that from the course.

Interviewer: Oh, that's a shame.

Caroline: I had 60 students lined up with things to print and I thought even if they fix it – it was just a time issue really, we ran out of time.

However, on a more positive note, Elizabeth explained the advantage of being able to use YouTube clips where you could see the process involved in a particular technique or method of making and then learn from that. This excerpt and photo describes how Elizabeth was able to use eLearning effectively in a textiles technology classroom:

Elizabeth: And I think the other.., and just being able to um for example, you know, if you are trying to teach um some new year nines how to thread a sewing machine and put a bobbin in. they can't all watch you at the same time

Interviewer: That's right

Elizabeth: So if, you know, they can just look at a YouTube um tutorial of how to thread the machine, of how to put the bobbin in and it doesn't really matter how fast or slow, they can just keep replaying it, replaying it

Interviewer: yes

Elizabeth: They don't need me there all the time

Interviewer: mmm

Elizabeth: Yeah so that's been good.

Elizabeth: You know, years ago we had big cardboard posters of how it all goes but now they can just look it up on their phone. … and any model, you might have 3 or 4 different sewing machine models … so they can look up what model … It's there.

Interviewer: yes, and all the manuals are online …

Elizabeth: so that's great.

Figure 13. A student using the YouTube tutorial to learn how to thread a sewing machine and insert a bobbin. Reprinted with permission.

So it was agreed between Elizabeth and the researcher that the sharing of online content and its instant accessibility was invaluable in a technology classroom. In a similar manner, Caroline also decided which eLearning strategies and digital tools to use depending on the availability of devices. Without direct access to a computer laboratory or bank of devices attached to her classroom, she was reliant on the students bringing their own devices. She explained, the students were reliant on their own devices *"… because you can't guarantee that you can get a lab so you can't plan a unit of work around counting on a lab being available.* She went further to clarify *"… if it is actually a plan of work that actually depends on devices, then I'll tailor it to the students I know who have them, so mainly the junior classes".*

Because the students can bring any kind of device to this school Caroline described how it can be quite difficult having this variety of Windows and Apple based devices along with the availability of different applications. This was not such a problem in Jane's classes as she also found that by using devices during hospitality lessons, the students were able to check how to do the culinary techniques and see if they were applying them correctly when using them. This had the potential to help them with

practical assessment tasks and also with understanding newly introduced culinary terminology such as different food types and how to cook them or how to pair them with other ingredients.

The teachers' comments also included the barriers they come across when deciding when and which eLearning strategies to use and the particular digital tool/s to use. Jane would plan work more for the junior classes rather than the senior students as they have access to their own devices. Caroline also said she would link the eLearning strategies or tools she used to whether or not the students had access to devices or not. Elizabeth felt the need for extra time to learn how to use the tools, and she commented *"just getting time to fiddle around and work with them".* She also felt strongly about the nature of professional learning and was concerned that this should relate specifically to the subject areas she taught in. Jane was also concerned with this lack of subject specific professional learning at her school and commented that, *"I find a lot of the ICT stuff we are getting at school doesn't actually relate to my subject"*.

4.4. Theme Three: Teacher perceptions of current and future eLearning needs of their students

This final section looks at the interview participants' views on the use of digital technologies in their classrooms, some of the issues that have arisen and how the participants feel it might progressed in the future. Although findings from the questionnaire are limited in this area, the interviews described the predominant concerns and benefits with using digital technologies in classrooms along with the teachers' views of possible future directions, some of which they are trialling now.

4.4.1. Results from the initial questionnaire

The initial questionnaire did not ask specifically how the participants felt about the future eLearning needs of their students. The perception of the current needs were looked at briefly in Question 5 and the types of useful applications they currently used and what they were used for which included assignment work, assignments, evidence gathering, research,

storage and collaboration. This was discussed earlier in the chapter using Table 4, which gave a summary of what the participants felt were the most useful eLearning tools for their classes. It also provided information on how these were used most successfully. Five of the teachers discussed the ability to share, display, plan and upload files and photos, along with carrying out research and learning certain practical skills.

4.4.2. Teacher interview results and introduction for Theme Three

The general indication from the participants in the interviews seemed to show the extensive thought and effort put in to their eLearning programmes. Jane's perception of the use of eLearning in her classroom is described as follows:

> *I guess the kids are excited by doing some eLearning, but you have to be careful that – it interests the kids instead of you just talking all the time and the kids are discovering things on their own, based around what you are trying to teach them.*

Although issues relating specifically to the teachers were not part of this questionnaire, it was interesting that the participants raised a number of these during the interview. Jane, for example, found that the sheer quantity of information meant there were many more teaching options, and she commented further that, *"it is just that you can do so much and show so much more than, you know, it is all just there available online".*
However, she also felt the issue of time was ever present and the amount of time to set up the students' activities tended to create extra demands on teacher time, she said,

> *It's taking a lot more time so really I would like to see allowances made for the amount of work that … computing has generated and for the extra demands and … instead of that happening, I think we are just getting more and more work piled on us and bigger classes.*

When looking towards the future of how digital technologies could be used in hospitality, Jane found during her overseas travels to San Francisco, a restaurant that did not have a maitre'd, at the front of the house or any serving staff, instead there were ipads for ordering. She explained, "*You*

pay and then your food's delivered … it's just chefs in the back working, deliver it and you just go and pick it up". She said there was no personal touch or the ability to impress with service but there were websites available like an "urban list" where the customers could go and find reviews for a restaurant. They could check what a restaurant was like and also pay by phone banking.

Jane found that students in her classes were technology focused and would multi-task, for example looking up techniques or ideas and collaborating with peers online. She felt this was because they had grown up with digital technology.

Looking at future needs of students, she said *"it has got to the stage now in education that you have to try and get them (students) to do things without their phones".* The students could still check the techniques they are using in practical work on their phones but then they could try utilising the information without the aid of a device. Jane also said she was finding that it was important to include practical activities in her teaching, *"it's a break for them from their phones".*

Jane was finding the senior students who were just relying on their phones for learning could be limited in what they could do and the information they could access whereas the junior students with their wider range of devices, which could be a tablet or a laptop, were able to accomplish more. She said, students use their devices or phones to complete inquiry learning work and also *"to check if they are doing techniques properly or you know what they should be doing"* online. She stated that this could include practical skills such as making sauces in the correct manner. Jane went on to say that the students are *"limited according to the device they have"* so she would send them to computers which were available in the Technology Lab. Jane believes that what is taught is linked to the devices the students have and the availability of eLearning tools, and this can sometimes be limiting.

Developing courses and finding solutions to issues when you are the sole subject teacher could be challenging and Jane found that it was valuable to have opportunities to discuss these with colleagues from other schools. One issue she found particularly worrying was the amount of time students spent on their devices and not engaging with other activities. She felt many of the students could not write properly and may be getting physical issues such as back and arm injuries from the excessive device use, for example, repetitive strain syndrome, which could affect their future learning.

With the larger school where Elizabeth works, there were more staff to discuss these issues with. The staff have many workshops and opportunities to learn new methods of doing things and she also says *"but probably not enough time to practice it".* She went on further to say that with the constantly changing education landscape everyone is just trying to keep up. In their digital technology department, Elizabeth described how there was a move away from a lot of written work, particularly in assessment in technology education, and evidence was now being collected through students videoed discussions. In some assessments students are required to video themselves talking about information and activities pertinent to their projects. With speakers of different languages students are also able to translate their maiden language to English by using different devices and digital tools.

Caroline was inspired by the year nines when BYOD was bought into her school. She did not need to give the students much instruction and she commented that they were able to make "*some really creative presentations and work".* They used programmes and applications she had not seen before and they were coming to secondary school from primary and intermediates schools with this knowledge. She felt that the LMS in the school, (XX)Net, was particularly useful. Caroline went on to explain, *"It's good there are things like (XX)Net* [which] *is really good for getting student work out, seeing what students can do, updating work from year to year".* She also said it made a great deal of content more

accessible. In addition Jane felt that when students assignments had been submitted and marked, and there was a need for alterations, it was much easier for the student to change a small part and resubmit it rather than when handwriting assignments.

Caroline also found that the ease of collaboration between students was particularly good especially if one of the group was away, the rest of the group could continue with their work. This collaboration requirement is shown in an introductory unit of work which she shared with the researcher, where the Year 9 students in the school worked on an inquiry project to research and design a Chef's Hat. This project developed skills for students working together and collaborating on their research, as the Design Brief instructions (Appendix 8) asks students to 'work in a group'. The brief was to design and make a functional model of an item of headgear to contain hair while the student was preparing and cooking food followed by researching and designing a new Chef's hat. This was able to be shared on one powerpoint or slideshow document which the students used to share their work with the teacher and present their findings to their class. Although there were issues with some classes being able to access devices, the Year 9 classes mostly had their own and if there were some without a device they were able to share. Where there was no BYOD it was more difficult and access to devices were a problem. The other issue Caroline found was that where students needed to research they would cut and paste information and regurgitate it, generally from only the top three sites on Google. She said, she discussed this with them and found they had not been taught how to write up the results of their research online, for example, using their own words, when finding information for their written reports or assignments.

Caroline thought that the future of education using digital technologies had potential to help students become more creative with the greater variety of strategies they could employ and the activities that were available for their use. The current students she taught in Year 12 were struggling to be creative using the technology. When she offered them a choice of

presentation type for a project where they were researching a particular issue to present, although they had a choice of whatever format they wished, for example, role-play, video, interview, magazine article, blog, powerpoint slideshow, her class all chose to write an individual written report. In addition the problem of trying to find a computer to use was a big issue in Caroline's eyes and so when they were not guaranteed access to them, they made choices based on this lack of access.

Caroline also felt the ability to become more fluent with digital technology in future would increase as they would have more access to the internet rather than relying on books for their information. The other issue she found was financial and where there was very little money being spent in the department on digital technologies, for instance, the food technology area, the priority of new technologies in the area came behind replacing aging equipment. So students working with the old equipment they had available in the school made it difficult for them to be fully prepared for any industry work requiring expertise in the use of these new technologies. This was especially due to the quality, quantity or lack of tools or space available for them to practice industry techniques in food technology.

It appeared that with a domestic type kitchen arrangement in the food technology classroom kitchens with small benches and little space to work meant it was very difficult to link the scientific skills and other skills required of food technology classes. The kitchen in Caroline's school was also shared with large junior classes and hospitality students. Caroline reflected that although there were some very exciting and engaging things you could do with food, she said, *"you do need the equipment and you need the space and you need the money to buy the equipment".* It seems that until this could occur, the future of food technology in Caroline's school and the use of digital technologies in a practical, and more scientific sense, as well as being closer to industry methods, was something that required more than just a device and internet connectivity.

With the future focus, Elizabeth commented that her school was starting to use different methods of collecting evidence, not just paper based but, as

she said, *"there is a bit of a move with technology assessment to go away from lots of written work and show evidence just even through … discussion, video, you know students videoing their work or talking about it".* She commented further that their department was discussing the different methods they could use to record student conversations about their projects, especially if the students were speakers of other languages, and the possibility of these being translated through different devices and digital programmes or applications. There were people in the school's technology department that had already worked in this way. She also found that it was taking a long time to become used to applying this method of evidence gathering and seeing it as authentic. So within food technology it could be like a TV food show where the students are being videoed while they are cooking and commenting on their processes. This could become the assessment evidence. A staff member in the foods department was already having the junior students' record themselves at home as part of their Year 9, project work. There were models of what the students were trying to describe, scenes that were videoed and so far these appeared to be well presented in a digital format.

The ease of being able to do these new tasks, as discussed by the participants, is giving them much more flexibility in their teaching and also in the students learning. The teachers who were interviewed all mentioned that the access to student work by both teachers and students was so much easier. They were finding they were constantly learning by being shown different things they could use digitally and new digital pedagogies, both self-generated along with those that they had been shown, which could be used in their programmes and these learnings passed on to their students. Caroline thought that the future would offer more opportunities for students' creativity and she was inspired by the ability of the Year nine, students who *came up with some really creative presentations and work*, much of which she had not come across before. Jane saw the possibility of being able to teach and work more from different locations, such as working from home.

4.5 Summary

In summary the participating teachers agree that by making use of digital technologies in the food and textiles technology classrooms, there is greater flexibility and variety of learning tasks. All the teachers surveyed used several forms of digital technologies in their teaching and learning programmes. The majority of each survey was completed by each teacher and some gave details of their most useful applications of digital technologies and additional responses which were most helpful. The teachers who completed the survey had between four and 37 years of teaching experience. Overall there appears to be a positive teacher attitude towards the use of digital technologies shown in the high use of different digital applications and software used. This included student learning management systems based on Moodle or other didactic online learning environments.

As the literature confirms, classrooms have been slow to see the effective integration of technology in many schools even though large amounts of money have been spent on professional development and training. (Ertmer & Ottenbreit-Leftwich, 2010). In this study, all the teachers who answered the questionnaire used a form of Learning Management System like Moodle or Ultranet and/or a cloud based Online Learning Environment like Google, Dropbox or OneNote. Learning to use these tools has probably been added on top of the teaching load of these teachers. In her thesis, Lewis (2014) discussed the amount of work required by tutors to support online courses and how the tutors had originally underestimated how long it would take to develop and teach online courses and this would probably be true for classroom teachers with their development of digital technology tools to assist student learning.

Theme one detailing the most useful digital technologies in food and textile classrooms showed that the teachers used many and varied tools and strategies. All the participating schools used an LMS however the platform where teachers share information (POND) was not widely used.

Theme two explored the teaching approaches to the incorporation of digital technologies by these teacher participants. The teaching approaches mainly relied on the Teaching as Inquiry model to guide their unit and lesson planning. This was used along with inquiry learning as a teaching strategy, with digital technologies making this type of approach more available to the students. Other extra demands were created for the teachers due to, time spent on professional development, along with learning to use the digital technology applications, and also having to understand the different models of computers the students bought to school. Therefore strategies for using digital technologies created extra demands on the teachers interviewed, particularly when it was not directly associated with their learning areas. Specific design of professional learning information is important for integrating digital technologies into subject areas and individual classrooms. As Koehler (2013) observed, teachers work in “diverse contexts of teaching and learning” (p. 14).

Theme three explored the teacher perceptions of current and future eLearning needs of their students. There were some very thoughtful comments made which balanced the sheer volume of information available to students and how to approach it in an educational manner. Jane, one of the participants, discussed overseas trends and how students need self motivation to learn and benefit from using techniques like inquiry learning. She talked about the distractions that Web 2.0 and social media can offer students so time wasting occurs if a teacher is not vigilant about keeping students on task.

Other challenges to the integration of digital technologies into teacher classroom practice included the lack of suitable facilities in some teaching areas. Positive findings included how students learning could be stimulated by the use online learning and how engaging some digital learning can be for them, being able to facilitate greater creativity from younger students and encouraging effective student collaboration. The most prominent feature from all the teachers interviewed was developing

their own ability and being willing to trial digital technologies to benefit their students' learning.

The next chapter aims to discuss the findings further with reference to the relevant literature outline in Chapter 2.

CHAPTER 5: DISCUSSION

The following discussion of findings will endeavour to explain what this study has found in relation to the main research question which asked how the pedagogy of food and textiles technology teachers is changing with the introduction of digital technologies. It will be organised according to the three themes identified in the Methodology chapter, and restated in section 5.2. Links will also be made to the literature review in Chapter 2 and these will be considered in relation to the research sub questions.

5.1. Introduction

Several research sources discuss the importance of pedagogy over the use of digital technology when it comes to learning within the various sectors of education (Bransford, Brown, & Cocking, 2000; Higgins et al., 2012; Livingstone, 2012; Pelgrum, 2001; Sheninger, 2017). In 2017 a New Zealand Education Gazette article, along with other web based Ministry of Education sources, showed where some teachers are integrating digital technologies in their programmes of learning in New Zealand secondary schools and using relevant pedagogical practice to do so (Education Gazette editors, 2017; Tamaki College students, 2017; Virtual Learning Network, 2017). However, in food technology, home economics, hospitality and textile technology classrooms is this the case? With the extensive content that needs to be covered in these courses are the teachers using digital technologies to enhance the students' learning and using them to teach effectively?

5.2. Discussion of findings

New Zealand educational policies for the integration of eLearning pedagogies in secondary schools have been provisionally included in the New Zealand curriculum where they are part of a teaching approach. These are being used to explore digital technologies to "supplement traditional ways of teaching" but also to "open up new and different ways of learning" (New Zealand Ministry of Education, 2007, p. 36). This is reinforced on pages 34-35, of the curriculum titled "Effective Pedagogy Teacher actions promoting student learning" where the use of the

“Teaching as Inquiry” model is explained as part of a teaching strategy. In response to Question 9 of the initial survey four out of the eight respondents indicated they used the Teaching as Inquiry model to link eLearning tasks to their teaching. Using this model will assist with effective pedagogy when teachers inquire into how eLearning strategies are benefitting their students.

All teachers who participated in the initial survey used the school Learning Management Systems or LMS which means that all the participants from five high schools/colleges are no longer using only traditional methods of teaching as defined by Allen and Seaman (2013) and shown in Table 2. In the SAMR model this would be classified under the heading of Substitution initially, where the information students require for the course is presented and can be accessed online rather than on paper. Using the TPACK model, and only using the LMS component in a course, would indicate that the participant was able to use the technologies but does not show considerable pedagogical or content consideration at this initial stage.

The use of the SAMR and TPACK models for the analysis of some of the data will be discussed as a useful method for portraying the pedagogical use of digital technologies in FTT teachers’ classrooms. These links to SAMR and TPACK models will be included to answer the main question of the study; how is the pedagogy of food and textiles technology teachers changing with the introduction of digital technologies?

The themes of this study were chosen to link closely with the sub questions of this research. They will be discussed in the following order.

- What are seen as the most useful digital technology tools by food and textile teachers for modern learning practices? This question was the focus of Theme One: The digital technologies used in Food and Textile technology classrooms.
- What are the approaches to the incorporation of eLearning into New Zealand classrooms and to what extent are they being used in food and textile technology classrooms? This question was the

focus of Theme Two: The teaching approaches to the incorporation of digital technologies in Food and Textile technology classrooms.

- What are the food and textile teachers' perceptions of current and future eLearning needs of their students? This question was the focus of Theme Three: Teacher perceptions of current and future eLearning needs of their students.

5.2.1. What are seen as the most useful digital technology tools by food and textile teachers for modern learning practices.

The most useful tools utilised by the participants in this study were the schools Learning Management Systems such as LMS, Moodle or UltraNet, or Online Learning Environments, such as OLE or Google classroom. Nine of the participants used these and this also allowed for the inclusion of other eLearning tools, for example links to Google documents. Teachers indicated in their survey that students they perceived to be of differing ability levels, all used the LMS during personal and class time. Only two participants indicated that the lower ability students did not use the LMS in their own time. Students also seemed to value the ability to use LMS in their schools according to the results of usage in Question 6 of the questionnaire. Parkes, et al. (2011) and Macfadyen, (2010) early findings from their research into the use of Learning Management Systems indicates that it is gives both the teacher and the students opportunities to use blended learning.

Question 10 of the survey asked for the software or apps the teachers used and for what purpose. There were both Windows and Apple based, along with cloud based applications that the participants used in their teaching and learning. Interestingly none of the participants used Skype or Apple Cloud, Khan Academy or embroidery machine software. Seven participants used Word, digital cameras and photos in both Windows and Apple based platforms, and six participants used Powerpoint. One of the participants mentioned that they used Word especially "As a backup to Google when Wifi down". A problem with digital technologies can mean that alternative solutions need to be found when the digital media is

unavailable for whatever reason. Digital photos are used mostly for evidence of student work and photographing food, recipes and products. Cloud based platforms were mostly Google Chrome, Google Drive and Google Classroom. Google classroom is similar to the LMS or OLE where teachers can post student assignment instructions, share teacher and student pages, feedback on student work in a private environment, message and email a class, make announcements and set or collect assessment work. Wright (2016) discussing the implementation of BYOD in a New Zealand secondary school explained that these digital technology tools were still at the trial or experimental stage.

As well as the school LMS, the Google platform was the cloud based tool that got the most responses, followed by Apple, as indicated in Question 3. As the Google suite of applications has developed teachers seem to find it more user friendly. In some cases, when linked to the schools' email addresses students can use the Google eLearning tools for storing information, documents, sharing and editing work, group collaboration, surveys, and reporting back to class. Teachers can get the students to do presentations with ease, upload photos for the students and give feedback or feed forward. As participants described in Question five this digital platform can also be used for marking work using real time collaboration if required. The variety of pedagogical use the Google suite allows has made it a very popular tool in the classroom with teachers.

Teacher participants' use of the Google suite of applications indicated that there are different stages of the SAMR model being applied in their teaching. Typically there was group collaboration, student presentations, along with sharing and editing work online in a classroom, demonstrating both the Augmentation and Modification stages of the SAMR model. Teachers using different stages of SAMR in their teaching indicated that they are using eLearning pedagogy and blended learning when deciding on the inclusion of these digital technologies. This leads us on to the next theme of looking at teaching approaches to incorporating digital technologies (Ministry of Education, 2017c; Tucker, 2013).

5.2.2. What are the approaches to the incorporation of eLearning into New Zealand classrooms and to what extent are they being used in food and textile technology classrooms?

Teacher participants in this study were using different digital technologies to incorporate eLearning. Those mentioned were Trello, Padlet, Pinterest, Wix, Prezzi, Weebly, YouTube and Powerpoint. In Question 4 of the questionnaire one participant included use of screencasting tools. Screencasting tools are complex digital programmes where images, video and text can be combined and edited to make a digital lesson or instructional video (Gormely & McDermott, 2011). This type of digital technology use requires all facets of the TPACK model to be in use. Although the TPACK model is complex, it can be a useful model for looking at pedagogical use of technology tools (Brantley-Dias & Ertmer, 2013). Put simply there are the links to the knowledge of how to use the screencasting technology, content knowledge to present and the pedagogy of ubiquitous learning where this video can be shared with students anytime, anywhere. Students' use of screencasting tools for learning in a study by Shafer (2010) and linked to the TPACK model likewise confirms that for teachers and students this digital tool has tremendous potential for them both (Gormely & McDermott, 2011).

Gormely & McDermott (2011) researched screencasting as a digital literacy and how enhancing literacy with audio and visual means can be used to motivate learners. In the study of screencasting use in secondary school mathematics by Shafer, (2010) students also showed enthusiasm for using screencasts to prove mathematical answers to problems posed. The students particularly seemed to benefit from the review of the completed screencasts and finding any errors made by their peers, which kept them engaged with the work. The face to face contact with their peers along with analysing the screencasting proofs they made created an interesting learning experience for the students. The *Mathematics TPACK (Technological, Pedagogical and Content Knowledge) Framework* developed by the Association of Mathematics Teacher Educators (Niess,

Ronau, Shafer, Driskell, Harper, Johnston, ... & Kersaint, 2009) was used to guide the learning experiences of these students using digital technologies.

The Teaching as Inquiry model, linking eLearning tasks to teaching and student learning, was used by Louisa, Mary, Caroline and Elizabeth and discussed by Caroline and Elizabeth in their interviews. This would indicate half the participants were using "evidence based pedagogy" along with effective teaching and learning (see Table 3) if TAI is being used productively. This model allows for a learner centred focus when teachers use it to inquire and reflect on their teaching and student learning. Hartnett's (2015) editorial in the *Journal of Open, Flexible and Distance Learning* gave this synopsis of the article by Anne-Marie Hunt, who reported on a blended course for beginning teacher education students. She explained these students undertook "their own research by inquirying into the practice of teaching in New Zealand schools and the e-tools and strategies that can support this process. Empowering teachers to research their own practice is certainly a future-focused endeavour." (Hartnett, Davis, & Fields, 2015, p. 3).

The findings for food and textile technology teachers changing their pedagogies is not clearly evident in this study due to minimal knowledge of how they taught before introducing digital technologies to their classroom. Although these teacher participants indicated implementing different digital technologies this did not directly indicate a change in the way they taught. Teaching methods, when analysed using the SAMR and the TPACK models, indirectly indicated that there had been change. Also without the availability of digital technologies previously, there were limited choices for teaching and learning methods available to FTT teachers. The technologies used were specific to its task for example, pencils for writing. (Koehler et al., 2013, p. 13).

Particularly pertinent are the comments made by Elizabeth explaining her use of YouTube with her textiles students, along with the photo of her student using this method of learning (see Figure 14). Another example is

Jane's use of YouTube and other digital video or visual tools in her Hospitality and other classes, to teach skills and knowledge regarding different culinary techniques. Previously, these skills may have been demonstrated by the teacher to a class or from a video or DVD. Students today are more able to access information and skills for their particular needs directly related to what they are studying or learning. Green, Facer, Rudd, Dillon & Humphreys (2005) included this type of activity and service in their study on *Personalisation and Digital Technologies*. This could give students ownership and control over their learning. Selwyn, (2009) recognises that students do need the authority of a teacher or librarian to ensure age appropriateness of on-line material as well as suitability according to their needs.

5.2.3. What are the food and textile teachers' perceptions of current and future eLearning needs of their students?

The participants interviewed showed a pragmatic use of technology responding to current educational demands and emphases. Projecting into the future was not a focus in the interviews. The main focus for the future was on developing what was already being used effectively in terms of digital technologies. There was also an interest in the types of environments where the teaching using digital technologies occurred. Caroline said "I think in the future they will be more creative. I think at the moment with the year 12s they are literally all around the school trying to find a computer". So she was mostly concerned with the equipment for both practical lessons and accessing digital equipment. With guaranteed access she felt the students would be more likely to do different digital tasks like blogs and videos especially with ongoing projects. She also discussed the physical layout of the kitchen and how it would be better if there was an area where students had access to space where there was computing and other digital equipment available during lesson time.

In the book *How people learn: Brain, Mind, Experience and School*, (Bransford et al., 2000), the design of learning environments was explored. It was found that it was important to re-think what had gone

before and question the way that future learning with digital technologies would impact on the learning environment. This was “particularly important given current data about human learning, namely, the degree to which learning environments are learner centered, knowledge centered, assessment centered, and community centered” (p. 131). In chapter one Bransford et al., (2000) also discussed research involving the mind and brain and cognitive skills required to learn and stated that “Emerging technologies are leading to the development of many new opportunities to guide and enhance learning that were unimagined even a few years ago” (p. 4). These opportunities are still evolving today. This scientific knowledge and research regarding how the mind and brain work in a learning environment is ever more important in the shifting digital society that we live in today for example Universal Design for Learning use applied neuroscience to give an idea of the type of teaching and learning a student may need (Rose & Meyer, 2002).

Beetham & Sharpe (2013) discuss the change in how students can learn using digital technologies and the increased focus on active learning rather than the sometimes passive education students received in the past. A large study into the implementation of digital technologies in several New Zealand schools by Benade (2017) also looked at the learning environment of the students when using BYOD and gives some insight into shifts in teacher practice. Along with a modest use of both community and student voices, Bernard argued that “given all that is claimed about the ‘Net Generation’, some students expressed the view that they learn more effectively using pen and paper, which they found to be less distracting than devices.” (p. 141).

An interesting point of view echoed recently in a newspaper column by Peter Lyons, a teacher from St Peters College, referring to devices as weapons of “mass distraction” (Lyons, 2017) because of the wide variety of other activites students can be doing on their devices other than what has been asked of them. He goes on to say that these devices are just tools and should not override inter-personal communication where

students are discussing, questioning and actively involved in practical work.

Also like many of Jane's comments, Benade's (2017) study also reported that the students themselves had health concerns especially around their poor posture. When they are hunched over laptops or working in different positions they find comfortable for example on a couch. However, without the correct chairs and tables this can cause problems with back strain particularly. Along with postural problems the study found "Some students complained of developing eyestrain and headaches. Other health-related concerns pertained to parental (and some student) concerns that students are overstimulated by excessive screen time, and that they were losing their ability to relate to one another at a human level." (p. 142).

5.2.4. Main research question: How is the pedagogy of food and textile technology teachers changing with the introduction of digital technologies?

Content Knowledge from the TPACK model is described as the knowledge teachers have about the subject matter they intend teaching and what students will learn from this (Koehler et al., 2013, p. 14). With food and textiles technology, the knowledge of the subject matter is vast, and like other secondary school teachers in New Zealand they have been especially trained in their field.

The subject matter becomes even more complex and options for teaching and learning can be affected when you include educational changes that have occurred over the years in New Zealand education, including the National Certificate of Educational Achievement (NCEA) and new technology curriculum documents from the curriculum review in 1985 to when the current curriculum was gazetted in 2007 (Granshaw, 2015; Jones, 2005). Street, (2006) discussed how responsive to change home economics teachers are and now as also food and textiles technology teachers how they are reflecting modern society, in addition to the constant changes from within a school environment with changing organisational systems and the new pedagogies required with the addition

of digital technologies. An example was Elizabeth's school introducing a Universal Design for Learning where the teachers' content knowledge had to increase with the requirement to include these new ideas in their pedagogy and teaching. As argued by Benade, professional learning becomes an important part of the integration of digital technologies and supporting innovative teaching particularly when it is specialised (2017).

The professional learning opportunities that the three teachers who were interviewed discussed included Teaching as Inquiry, BYOD, completing university, and/or subject association courses or upskilling opportunities, observing practice of teachers at other schools, Universal Design for Learning and inquiry learning, amongst others. Integrating these practices with digital technologies within their pedagogy along with assessment and reporting student attainment (Koehler et al., 2013) has been and continues to be a strong feature of what the food technology, hospitality, and textile teachers in this study have done very well. The integration of digital technologies does not seem to have changed this flexibility and adaptability for the teachers in this study. The participants appear to be using the technologies with their diverse range of students and gauging what is useful and effective for learning in their own subject contexts. Teachers' pedagogy is changing to effectively fit the needs of the students using digital technologies where necessary. As teachers they seem to have done what they always do, professionally, integrating the most effective teaching and learning tools to enhance their students' learning using the best tools available.

5.3. Summary

The participants' views on the effects of digital technologies on their teaching and learning in food and textiles technology classes have been very positive amongst the teachers who took part in this study. With an aging population of subject teachers in these areas, and the added issue of recruitment and retention along with supply and demand of technology teachers (Fergusson, 2008; Street, 2006; Robertson, 2005), their ability to incorporate modern learning practices, which they were often not initially

trained in, has been time consuming and complex work (Koehler et al., 2013). Helping to improve students' lives by the teaching of both technical and life skills in the areas of food and textiles continues to be an important part of their education. The following concluding chapter discusses some of the implications of the inclusion of digital technologies in food and textile technology classrooms.

CHAPTER 6: CONCLUSION

The previous chapter drew some conclusions from the previous two chapters around Findings and the Discussion of the findings of this study on the effects of digital technologies on teaching/learning in food and textiles technology education. The National School Sampling Study (NSSS) discussed by Jones, Harlow and Cowie (2004) reported that the technology areas most widely taught in New Zealand schools were food and materials (including textiles). These learning areas are ones that are directly linked to careers and are practical and “hands on” with problem solving and decision making skills that will always remain intrinsic to all our lives. Koehler et al., (2013) discusses the highly complex and dynamic classroom structures which are constantly changing and evolving in these subject areas. Continuing creativity and evolving course structures and content are seen as essential to developing teaching and learning into the future. The TPACK framework is a tool that can assist with navigating the complexity of this task within the different subject contexts.

The NSSS also found that the most important factor influencing the provision of relevant and accessible technological experiences was the amount of teacher knowledge (75%), (Jones, et al., 2004). In this study teacher participants who have been using the Teaching as Inquiry model for planning tasks and reflection have also shown higher rates of integrating different digital technologies into their teaching and learning. The focus provided and the teaching and learning inquiry process used in this model can assist with reflection on digital technology usage and the benefits (or otherwise) that have occurred. (New Zealand Ministry of Education, 2007). Teachers are showing some thoughtful integration of digital technologies and a desire to use some of the available online resources.

However, critical thinking is an important component for using digital technologies within educational settings, particularly for future orientated learning. We need to be wary of technology focused zealots and big IT companies when we consider whose interests are being served. Livingstone (2012) challenges some of the learning benefits due to

confusion over the clarity of purpose in digital technology usage. As digital technologies are integrated we do not want to forget the lessons and practices of the past. This should help us grapple with the “myth of the future” label, when applied to the discussion of the on-going projections around technological development and change (Facer, 2011). Food and textiles technology educators are well placed to look at this educational, social and technological change as they have the links between past best practice and future possibilities in two of the largest industries in New Zealand and globally (Islam, 2018).

Although there have been barriers indicated including access, rate of change and cost of digital technologies, these are slowly being addressed. The benefits available to the students from the use of digital technologies will allow them to participate in this rapidly changing world. They enhance their ability to be more creative with ideas and processes and can assist them in finding solutions to problems while building sustainable and connected communities.

Research in the area of technology education and the integration of digital technologies is still ongoing as can be seen at the Pupils’ Attitudes Towards Technology (PATT) conferences and the most recent 2017 Technology Education New Zealand conference. Technology teachers are also supported by online communities such as Techlink, POND and subject associations like Hettanz, and Tenz, who are assisting future-focused teachers with digital technology use in education. Thomas (2018) recently discussed the challenges and opportunities for digital technologies and growth in the technology industry sector in New Zealand. This indicates that we need to prepare our students for current technology-based careers and the new, innovative and exciting jobs, processes and challenges that the future will present.

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Appendix 1 – Covering email letter to school principals

[Date]

[Address]

RE: Survey on **Participants' views on the effects of digital technologies on their teaching/learning in food and textiles technology education.**

Dear [Name],

My name is Sharyn Gee and I am a Food and Textiles technology teacher at Glendowie College and currently completing a Masters of Education at Waikato University which involves a research thesis.

This research will look at Food and Textiles teachers' views on the effects of information and communication technologies on their teaching and the students learning in New Zealand. It is my aim to collate information and analyse it to further assist technology teachers with understanding the use of information and communication technologies in our subject area.

I would like to invite food and textiles teachers at your school to consider participating in this research. It would involve answering a 10-20 minute survey, and also a possibility that a few participants will be contacted to conduct a 30-40 minute interview, at a time convenient to them. I would appreciate it if you could give your consent by emailing me by return at sg89@students.waikato.ac and I will be able to contact them.

Currently, there is very little information available for our subject area in blended learning and how it can prepare our students for their future endeavours. It is anticipated that the results from this study will further support teachers to integrate digital technologies effectively for student learning. I would appreciate your support and approval by consenting to allow your food and textile teachers to assist with this research. Should you have any queries, please do not hesitate to contact me on 021-1634550 or email sg89@students.waikato.ac.

Thank you in advance for your time and consideration,

Yours sincerely,

Sharyn Gee

Attached: Consent Information Form for School Participation

Appendix 2 – Covering email letter to teachers

[Date]

[Address]

Dear [Name],

RE: Research survey on the use of Information and Communication Technology (ICT) and its introduction into food and textile technology teachers' classrooms - **Participants' views on the effects of digital technologies on their teaching/learning in food and textiles technology education.**

I appreciate your time in reading this letter of introduction. I am currently studying a MEd at the University of Waikato in Hamilton, part-time and a teacher of Food and Textiles technology at Glendowie College in Auckland and I am inviting you to take part in my research project with an aim to assist us all in the use of ICT in our classrooms.

If you would like to participate in this study please complete the attached survey at this link: [survey link]. To ensure integrity and confidentiality, I can assure you that all the collected data will be stored securely; all your responses will be kept strictly confidential. All the analysis and any reports will purely be based on statistical aggregates. Thank you for taking your valuable time to complete this questionnaire survey.

Your completion of the survey will constitute consent to participate in this research. I would appreciate it if you could complete this questionnaire before 30 July 2015. I may follow up this email with a request for a short follow up interview at your convenience. If you would be willing to participate in the interview, could you email me by return. Should you have any queries, please do not hesitate to contact me on 021-1634550 or email sg89@students.waikato.ac

Thanks again for your help and support.

Yours sincerely,

Sharyn Gee

If you would like to discuss any concerns about this project you may contact: Dr. J. Williams, TEMS Education Research Centre, University of Waikato. Phone: (07) 8384500 extn 4769 or email: pj.williams@waikato.ac.nz

Attached: Completed Consent Information for Participation by School

Appendix 3 – Consent Information for participation by school

CONSENT FORM

Project Title: Participants' views on the effects of digital technologies on their teaching/learning in food and textiles technology education.

Researcher's name: Ms. S. Gee

• I have received information about this research project.

• I understand the purpose of the research project.

• I understand that while statistical information gained during the study may be published, the participant will not be identified; and all data will be treated with confidentiality.

• I understand that while every endeavour will be made to ensure confidentiality, this cannot be guaranteed.

• I understand that we may withdraw from the research project at any stage until data analysis commences.

• If you require further information please contact the researcher by email sg89@students.waikato.ac or if you would like to discuss any ethical concerns about this project you may contact: Dr. J. Williams, TEMS Education Research Centre, University of Waikato. Phone: (07) 8384500 extn 4769 or email: pj.williams@waikato.ac.nz

• I have given consent to the above by emailing this consent by return.

Name of Principal: [Participant Name]

Name of School: [School Name]

Date: As per email

I have provided information about the research to the research participant by email and believe that he/she understands what is involved.

Researcher: S. Gee

Date: As per email

Appendix 4 – Consent form for teacher interview

CONSENT FORM

Project Title: Participants' views on the effects of digital technologies on their teaching/learning in food and textiles technology education.

Researcher's name: **Ms. S. Gee**

- I have received information about this research project.
- I understand the purpose of the research project.
- I understand that while statistical information gained during the study may be published, the participant will not be identified; and all data will be treated with confidentiality.
- I understand that while every endeavour will be made to ensure confidentiality, this cannot be guaranteed.
- I understand that I will be voice recorded during the interview.
- I understand that I may withdraw from the research project at any stage until data analysis commences.
- I give permission for any resources I share with the researcher to be used as part of the study and understand the source will be kept confidential.
- If you require further information please contact the researcher by email sg89@students.waikato.ac or if you would like to discuss any ethical concerns about this project you may contact: Dr. J. Williams, TEMS Education Research Centre, University of Waikato

Name of Teacher: _____

Signed: _____

Date: _____

Appendix 5 – Questionnaire

Project Title: Participants' views on the effects of digital technologies on their teaching/learning in food and textiles technology education.

Question 1 – Food and Textiles technology teaching experience – Please enter the number of years you have taught each subject and in the appropriate year level box/es.

Subject/s Taught	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Food Technology							
Hospitality							
Textiles/Fabric/ Soft Materials Technology							

Question 2 - Do you use a Learning Management System (LMS) and/or cloud based data online community for student learning? Please tick appropriate box/boxes for the amount of time you use each ☑

	Never used	Use occasionally	Use often	Use every lesson
Moodle				
Ultranet				
Google				
Apple				
Dropbox				
OneNote				
POND				
Other – please name				

Please include any other information regarding the use of Learning Management Systems:

Question 3 – What information and activities have you used on your LMS/Cloud to teach Food Technology or Textiles Technology? Eg Course details, Forum, Youtube or video clips, interactive activities, Please tick appropriate box/boxes ☑

Information &/or Activities	Please tick appropriate box/boxes ☑	Information &/or Activities	Please tick appropriate box/boxes ☑	Information &/or Activities	Please tick appropriate box/boxes ☑
Course details		Forum		Presentation	
Year-plan		Youtube clips		Powerpoint	
Course information		Wordle		ScreenCast tool	
Pictures or Images		OneNote		Prezi	
Worksheets		Facebook		Photoshop	
Video/DVD		Blog		Podcasts	
Links to educational sites eg NZQA		Wiki		Links to online resources eg CreativeBug	

Please add any other activities you use on the LMS/Cloud here:

Question 4 – Can you list what you have found the 3 or more most useful applications and what you use them for? Eg Forums – students discuss tasks with each other;

Activities – Watching You-tube and making notes, Research, Using Tumblr for images, Facebook;

Assessment – Powerpoint or other presentation tools, please name the digital tool;

Sharing information in groups on-line – Trello, Edmodo, Google docs;

Do the students suggest possible eLearning tools to use eg eBooks, etc.

Application	Students use for …

Question 5 – How often do you feel your students use the LMS? Please tick appropriate box/boxes ☑

Student ability	High Ability Student				Middle Ability Student				Lower ability student			
How often	Never	Occas-ionally	Often	Every	Never	Occas-ionally	Often	Every Lesson	Never	Occas-ionally	Often	Every Lesson
Classtime												
Own Time												
Other												

Question 6 – What classroom activities do your students use their BYOD devices for? Eg Research, Documents, Presentations, Filming, Photographs, SurveyMonkey for questionaires, emailing stakeholders, Skype to contact and speak to stakeholders etc.

Question 7 – Have you used the SAMR model (Substitution, Augmentation, Modification, Redefinition) as a tool when developing eLearning activities and lessons?

Question 8 – How did you link the eLearning tasks to your teaching and the students learning? Eg transfer paper-based worksheets onto LMS for students to fill in, used a Teaching as Inquiry model, used learning objectives in your schemes, using the SAMR model etc.

Question 9 – What software or Apps do you use and for what purpose (and for which year level/s where applicable)?

Windows based

Microsoft Office	
Word	
Excel	
Powerpoint	
Camera/Photo	
Publisher	
Photoshop	
Other software:	
Khan Academy	

Apple based (iphone or ipad or MacBook)

Camera/Photo	
Camera	
Pages	
Numbers	
Edmodo	
Other Apps:	

Cloud based eg google email, drive,

Google Chrome ……	
OneNote	
Skype	
TechLink	

Question 10 – a) Please indicate how long have you been teaching in total? _____ years.

b) Which subject areas and number of years you have taught that subject? Please enter the number of years you have taught each subject in the appropriate boxes.

Subject	Years taught in total
Food Technology	
Textiles Technology	

Hospitality	
Other Technology/s (Indicate how many years for each subject taught please)	
Design and Visual Communications (Graphics)	
Information and Communication Technology	
Hard Materials	
Biotechnology	
Electronics	
Materials	
Other subject/s: (please name them)	

Question 11 –Are you Male/Female? Please tick ☑

Male	Female

Question 12 - Would you be willing to meet with the researcher for a 30-40 minute interview to expand on this questionnaire? Please tick ☑

Yes	No

Thank you so much for your valuable time ☺

Appendix 6 – Semi-structured interview questions

Project Title: Participants' views on the effects of digital technologies on their teaching/learning in food and textiles technology education.

Thank you for completing the initial questionnaire and agreeing to meet with me, your information will be kept confidential. Attached is a copy of the abstract for you.

Would you mind if I record our session as well as take notes on this – I will give you a copy of your completed questionnaire also if you would like to take any notes or add additional information. I will scan and email you copies of these sheets for your approval also.

(Precise questions may be dependent on the questionnaire answers so these are generic questions at present).

1. a) Have you taught at any other schools?
   b) Was the information from these schools added into the initial questionnaire or was the questionnaire only answered on information from this school?
2. a) Did you do your teacher training in NZ or elsewhere?
   b) Who provided your training? Was it a degree course?
   c) Was there any ICT training included?
3. What professional learning do you like to do? Eg InHouse, Hettanz, TENZ, further study
4. Is there any ICT based professional learning that you prefer? Eg linking to the SAMR model, Teaching As Inquiry
5. Which have been your most successful eLearning strategies that you use in classes? Are any of them specific to your subject area/s eg CNC programming by Bernina EditorLite V4 for embroidery machines.
6. a) How do you decide which eLearning strategies or tools to use?
   b) Is it linked to the types of devices the students have access to?
   c) Are you a BYOD or 1:1 school?
7. Do you have a copy of your planning for an eLearning strategy handy that you are prepared to share?
   a) What was the purpose of this learning activity?
   b) What do you think is the underlying pedagogy?
   c) How does the eLearning activity shape this task? Any advantages or disadvantage of using the ICT in this task?
8. What are the highlights from inclusion of eLearning and ICT in your teaching?
9. What do you think are the difficulties in the inclusion of ICT?
10. Do you have access to embroidery machines, 3D printers or Pattern-Making programmes or any other specific equipment that require ICT input and if so how are they used?
11. Where to from here? What do you think will be some future eLearning directions for our subject area are?
12. Could I please get further clarification on answers to question/s _____ in your initial questionnaire? Is there anything else you would like to add?

Thank you so much for your time, I will be emailing you the transcript of this interview for your approval. ☺ Every endeavour will be made to ensure confidentiality, however, this cannot be guaranteed.

Appendix 7 – Initial theme development

Interview Codes – emerging themes from teacher interviews (QDA miner lite)

Teacher prior DT Knowledge	Professional learning	Student use of DT	Digital Technology (DT)	Lesson planning	Teacher specific info	Subject specific info
ICT/DT training prior to teaching Teacher Training Degree courses e.g. BEd	Whole school Technology department Subject specific Subject associations Outside PL/PD Industry links	Project based learning Google Social On-task, off-task Digital distractions Social media Convenience of use Junior vs senior DT uses	Student Learning Management Systems (SLMS) Internal systems External systems e.g. Google DT tools e.g. embroidery machines, 3D printers Subject specific DT Cybersafety	Subject specific Inquiry learning Teaching as inquiry eLearning strategies Digital eLearning tools for learning e.g. word clouds, kahoot, youtube	Collegiality Helpful knowledge for F&T teachers Digital eLearning tools for collaboration e.g. POND Own use of DT Workloads Most useful DT's	Practical work Health and safety Room uses
Content Knowledge	Content Knowledge	Pedagogy	Technological knowledge	Pedagogy	Pedagogy/ Technological	Content Knowledge

Interview Codes – emerging themes from teacher interviews (QDA miner lite) continued.

Affordances	Barriers	Future Use	Learning styles	Pedagogy	Computer accessibility	School specific
Benefits of DT use Effective use of DT Cloud storage Highlights of DT use	Barriers to DT use Student distractions Problems with particular subject area Difficulties Costs	21st C learning Future eLearning directions/uses Modern learning environments Modern learning practices New technologies Future eLearning needs	Traditional teaching – Talk and Chalk Traditional learning – pen and paper Digital natives	Evidence of student work	BYoD Computer rooms Wifi	Class sizes Access to DT's Policy
			Pedagogy	Pedagogy		

Appendix 8 – The Chef's Hat – Design brief

Design Brief: CHEF'S HEADGEAR

You will work in a group through the process of designing, functional modelling and assessing a product which will keep hair out of food while you are preparing and cooking.

Students in our group:

Situation:

Chefs all over the world use various methods to keep their hair covered while they are preparing and cooking food. This ensures that their hair does not fall into the food and also means that they are less able to touch their hair while cooking and to transfer any bacteria from their head/hair onto the food.

Brief:

You are to design and make a functional model of an item of headgear to contain hair while you are preparing and cooking food.

Specifications

1. The headgear must keep your hair covered and/or contained
2. It must be secure

Plan of Action:

1. Research current headgear used by chefs. Draw or print images of these onto the next page or use your own device to draw or upload images.
2. Using the data you have collected, produce two CONCEPT IDEAS. You should draw and annotate (label) your drawings. Share your concept ideas with the other members of your group and with your teacher, using your workbook or Google Drive.
3. After discussing all of your concepts choose one which will fit the brief and specifications and develop it further until you decide on your FINAL DESIGN. Draw and annotate your final group product.
4. Fill in the sheet headed "Key Questions – Soft Materials (Fabric)" or design your own sheet using your device.
5. Functional modelling – in groups, functional model your design using A4 paper to make a small model of your chef's hat. Record your progress by taking photos or video
6. In your group develop a Powerpoint showing your design process, how you functional modelled it and how it fits the specifications.
7. Take measurements and make a newspaper pattern for the actual hat. Write up instructions for making it so that anyone could use your pattern and instructions to make your hat. Share Powerpoint and instructions with your teacher
8. Evaluate your product - Every group member needs to complete their own evaluation.