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The potential for a future-focused curriculum in New Zealand: The perceptions and practice of six secondary school technology teachers

A thesis
submitted **in fulfilment**
of the requirements for the degree
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at
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ABSTRACT

Technology education is a subject that has seen significant conceptual change within its curriculum since its inception. In New Zealand, the national curriculum positions technology education as a means to expose students to learning, which can be future-focused in nature. The subject affords opportunities for pedagogical practice to be responsive to student interests and focused on technology-related issues and societal need. Students' learning has the capacity for creative and critical thinking in a variety of learning contexts and technological areas.

This qualitative research uncovers new knowledge about the nature and enactment of technology education in New Zealand, using a combination of interpretive, sociocultural, and case study methods. It explores how six teachers' perceptions affected their interpretation and enactment of the technology curriculum in two secondary schools. One school was well established, and the other was a newly built Innovative Learning Environment (Ministry of Education (MoE), 2017a; Osborne, 2016). Data relied on several primary sources, namely the New Zealand curriculum document (MoE, 2007) and its supporting materials (MoE, 2010), two or three semi-structured interviews per participant, lesson observations, department meetings, teacher reflections, and teacher-generated resources. Activity theory was the interpretive framework used to establish each teacher's circumstances and experiences.

The findings confirmed that teachers' perceptions directly influenced their interpretation and commitment to the curriculum's enactment. There was disparity between some teachers' espoused perceptions and manifesting practice, as determined by their cultural context. The most limiting perceptions were that students should first be taught teacher-designated skills and knowledge, and that it was satisfactory for technological outcomes to be replications or adaptations of existing products rather than to be innovative or future-focused in nature.

When interpreting the curriculum, all teacher participants in the study defaulted to the *Technological Practice* strand because of its association with practical outcomes. There was some hesitance to engage with the *Nature of Technology* strand, which was perceived by the teachers to be more conceptually challenging and less valued by students. Whilst some teachers aspired to foster a learner-

centred classroom, there was acknowledgement that to do so, students were required to be self-regulating and actively engaged in their work.

It is concluded that technology teachers' perceptions and practice do not necessarily explicitly align with the concepts outlined in the New Zealand curriculum (MoE, 2007). This research challenges the notion that if a teacher is knowledgeable about their specialist area of technology, they can effectively interpret and make meaning of the generic curriculum concepts for their own teaching practice. This is significant because in a context where teachers are encouraged to be curriculum decision makers, such a gap in professional knowledge signals a barrier to its enactment. It is suggested that to address this barrier, teachers need to adopt a form of "technological thinking" in support of their existing "technical thinking" (Reinsfield & Williams, 2017).

This research illustrates how technology teachers' perceptions can enable, moderate, or limit, their capacity to make the connection between curriculum and practice. How teachers make meaning of the curriculum to develop their knowledge for practice is presented as a threshold concept (Meyer & Land, 2003, 2006; Peter et al., 2014). Some enablers to practice are proposed. To enable change there needs to be a sustained and collaborative approach to support technology teachers' evolving pedagogical practice, which centres on learner-centred pedagogies and demonstrates a commitment to the enactment of the curriculum (MoE, 2007). I conclude by proposing a professional learning model, intended to support teachers who are motivated to reflect upon and transform their perceptions and practice, and to align their teaching with current policy and practice in New Zealand.

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CHAPTER ONE: INTRODUCTION

1.1 Introduction

The *nature of technology education* is a term used to describe the way that the subject is conceptualised at macro and micro levels in New Zealand. For example, technology education is heavily influenced by political agenda and the perception that its role is to develop students who can contribute to the national workforce, particularly in the Trades (Reinsfield, 2014; Reinsfield & Williams, 2017). Such a driver is disparate to the aims of the New Zealand curriculum, which states that the intent of technology education is to “develop a broad technological literacy that will equip [students] to participate in society as informed citizens and give them access to technology related careers” (MoE, 2007, p. 32).

A focus on technological literacy in this thesis should not to be confused with the notion of digital literacy or fluency, although they are both pertinent to technology education. Technological literacy is presented here as a capability that can be developed through the enactment of technology education, which exposes students to learning about the way that products work, are developed, and have implications for society (Dakers, 2006). Dakers (2006) argued for students to be guided towards a critical awareness of what it means to live and interact with a technologically mediated world. This is a perspective for which I advocate throughout the thesis.

The term *future-focused* is also used throughout this research in the context of both the subject’s evolution and to describe the government-advocated pedagogical practice in New Zealand. Teachers in New Zealand are encouraged by government to adopt a “future-focused approach” to education within learning communities, which are sufficiently flexible to accommodate students’ learning needs, are situated within open and adaptable teaching spaces, and harness the use of digital technology (Leggat, 2015; MoE, 2016a; Organisation for Economic Co-operation Development (OECD), 2013). The purpose of this research is to determine how technology teachers are responding to a need to develop their practice, as well as how this is mediated within school-based professional learning activities.

1.2 Problem statement

Literature that focuses on the purpose of education describes citizenship, student development, occupational preparedness, as well as social and economic outcomes as drivers for a school based curriculum (Adler, 1982; Tyack, 1988). Technology education in New Zealand has experienced significant conceptual change within its curriculum and is heavily influenced by governmental agenda, community expectations and teachers' differing perceptions of the purpose of the subject (de Vries & Mottier, 2006; Jones, 2009; Jones & Carr, 1992; MoE, 2014; Reinsfield, 2014). Perceptions are defined here as being about teachers' values and beliefs, their aims, perceived roles and understandings of curriculum discourse, and meaning making in their school context.

The role and status of technology education has evolved, but its cross-disciplinary nature means that there is no single theoretical perspective that can define it (Pacey, 1992). This uncertainty presents a confusing climate for some technology teachers but also offers potential for a research context, which can provide insight into how teachers navigate the challenges within their professional practice. From my perspective, technology education yields unique opportunities to engage students in their learning through practical and innovative means. There are various types of understanding underpinning the subject, including practical, conceptual, and tacit knowledge (Hill, 2003). The differing conceptions are all equally important and contribute to students' understanding of the nature of technology education. This notion is of interest in a climate where teachers are expected, according to the curriculum requirements, to foster creative and critical thinking and develop students' practical skills (MoE, 2007). There is also an expectation that students' experience technological practice within differing specialist areas of technology in a manner that is distinct from the subject's technical roots.

The official New Zealand curriculum in technology education (MoE, 2007) counters past interpretations of the subject and provides opportunities for teachers to offer future-focused and innovative learning for all students and accommodate their social or academic needs. Teacher perceptions and the dominant discourse within a teaching community however, influence the way that professionals interpret, make meaning, and develop their professional identity or practice

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(Biggs, 2006; Brookhart & Freeman, 1992; Dakers, 2006; de Vries, 2005; Fox-Turnbull & Sullivan, 2013; Hoyle, 2008; Kadi-Hanifa & Keenan, 2016; MacGregor, 2017; Zlatković, Stojiljković, Djigić, & Todorović, 2012).

In New Zealand, a teacher is encouraged to take personal responsibility for their engagement with an official curriculum (MoE, 2007). In technology education, teachers are required to make meaning of curriculum concepts for their specialist area (e.g. biotechnology, digital technology, food technology) in order to enact pedagogical approaches that respond to student need. Some teachers of technology appear to find this process difficult however and can be regressive or indifferent to the enactment of their subject (Jones, Harlow, & Cowie, 2003; Mansell, Harold, Hawkesworth, & Thrupp, 2001; Paechter, 1995). Some teachers communicate historical understandings of the nature of technology education, whilst others might align with the more contemporary view that a teacher's role is to respond to their students' social and academic needs (Jones, Bunting, & de Vries, 2013; Jones & Compton, 2009; Reinsfield, 2012; Williams, 2009).

Technology teachers can be affected by the discourses within which they practice. This research is significant because some technology teachers' perceptions and attitudes towards the nature of the subject are strongly embedded and can align with a view that content should centre on "design and make" activities (Williams, Jones, & Bunting, 2015, p. 2). In this case, a practitioner's focus might emphasise the teaching of practical skills, which may be to the detriment of students developing critical, creative, and informed thinking processes. Teachers' evolving knowledge for practice, in relation to their curriculum understandings, can be shaped in culturally meaningful ways (Hill, 2003). There is a paucity of research to provide insight into the meaning making processes required to enable the transition from curriculum concept to enactment. Interest in a perceived disparity between theory and practice in technology education led to the overarching question guiding this research, which is:

How do technology teachers' perceptions influence their interpretation and enactment of Technology in the New Zealand Curriculum (MoE, 2007)?

The ways that teachers of technology mediate their professional experience and practices to engage with the curriculum in their school was considered pertinent to this research question. There was interest in the strategies used to assist teachers

to make meaning of the curriculum for purposeful application in their practice. The sub-questions designed to explore this notion were:

How do teachers *interpret* the concepts presented within the official technology curriculum (MoE, 2007)?

How do teachers *enact* the concepts presented within the official technology curriculum (MoE, 2007)?

1.3 Rationale and aims

The purpose of this research was to understand how technology teachers interpret, make meaning of and enact the concepts presented in the New Zealand curriculum (MoE, 2007) in their schools and for the students in their care. I sought to explore the ways that technology teachers' perceptions influenced their practice during professional development activities and in their teaching practice.

By focusing on official discourse, in this case the technology education section of the New Zealand Curriculum (MoE, 2007), I was interested in how teachers' understandings were constructed and influenced by their professional experiences and school settings in order to develop understanding of any tensions between educational policy (the technology curriculum) and teachers' discursive practices (Franklin, 1999).

The literature suggests a need for technology teachers to continue to develop their professional understandings in order to accommodate the complexity of teaching within their discipline (Jones, 2009; Williams, 2012; Williams & Lockley, 2012). Jones, et al., (2013) indicate that research in technology education should focus on the teacher and how their understandings are translated *into* practice. This research aims to provide insight into this issue, initially for technology teachers, but potentially for other practitioners who are experiencing difficulty making meaning of the curriculum for their own evolving practice.

1.4 Overview

Technology education in New Zealand is a mandatory subject within the compulsory schooling system from Years 1 to 10 [age 5 to 14 years]. The reality for some technology teachers is that their subject's position remains tentative and is influenced by governmental agenda, community expectations, and their own

perception, which in turn impacts the nature and purpose of teaching in their school context. Technology education can be taught through a variety of different areas, including structures, control, food, information and communication technology, and biotechnology. Technology education is defined in the New Zealand curriculum as

...Intervention by design, the use of practical and intellectual resources to develop products and systems... that expand human possibilities by addressing needs and opportunities. Adaptation and innovation are at the heart of technological practice. Quality outcomes result from thinking and practices that are informed, critical, and creative. (Ministry of Education (MoE), 2007, p. 32)

The subject has three strands: *Technological Practice*, *Technological Knowledge*, and the *Nature of Technology*. *Technological Practice* comprises content from the previous curriculum document (MoE, 1995) and targets concepts that inform the development and making of products. *Technological Knowledge* focuses on the processes and properties of materials that can be used during product development. The *Nature of Technology* strand acknowledges the conceptual understandings required for students to “critique the impact of technology on societies and the environment and to explore how developments and outcomes are valued by different people in different times” (MoE, 2007, p. 32). To address the *Nature of Technology* strand, teachers are required to foster students’ critical thinking and encourage discussion about past and future technological responses with a view to supporting them to become informed consumers who can think “outside of the box” (Reinsfield, 2015).

This research investigates how teachers’ perceptions influence their engagement with, and enactment of, Technology in the New Zealand Curriculum (MoE, 2007) within the junior secondary school context (Years 7 - 10). My experiences leading to the study are outlined in the next section, followed by a background to the research, which describes some potential reasons for the disparity between policy and practice in technology education.

1.4.1 Researcher’s background

My engagement with this research results from over twenty years of teaching Design and Technology at secondary and tertiary level, in both England and New Zealand. My professional experiences have led to an appreciation of the complex

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issues influencing the subject's transition from being predominately practically based to including a more explicit theoretical dimension.

After I emigrated from England to New Zealand, I secured my first teaching role in this country in 2006, in a large (single sex) inner-city secondary school. My initial impression was that the governmental agenda emphasised teacher accountability, economic growth, efficiency, productivity and standards. This mirrored my professional experience in England. During my transition into this new cultural context, a new curriculum was being developed, which emphasised the notions of personal development, individual freedom, and human relationships (MoE, 2007). Technology education was to include a new focus on the philosophical nature of the subject, which led to a lessened emphasis on the practical skills that had been its defining feature in the past.

During this time, I was required to revisit my professional experiences to develop new theories and practices. This included coming to terms with the view in New Zealand, which asserts that teachers should make their own meaning of the curriculum and develop pedagogical strategies to accommodate and support students' academic and social needs. This process was expedited when I invited to participate in action-based research, entitled the Beacon Practice Technology Project (Compton & France, 2007). The Beacon Practice Technology Project was developed to trial some of the concepts within the newly conceived curriculum strand entitled the *Nature of Technology* (MoE, 2007, p. 32). The purpose of this strand was to develop students' understanding of the impact of technology on societies and the environment and to explore societal values both in the past, present, and for future scenarios.

To further develop my understanding of the nature of technology education, I became a New Zealand Certificate of Educational Achievement [NCEA] marker and was involved with the Curriculum Re-alignment Project (MoE, 2010). This project involved reviewing the standards for the National Certificate in Educational Achievement (NCEA), to ensure that they aligned with the focus of the new curriculum (MoE, 2007). NCEA (New Zealand Qualifications Authority [NZQA], 2012) is currently New Zealand's main secondary school qualification. Within such a framework, students are able to choose learning programmes from a range of subjects and they are assessed against either Achievement or Unit

Standards. These professional experiences provided me with further insight into the ways that students could be effectively supported towards learning success in the secondary school context.

In 2010, I was awarded a Teach NZ Study Award. This facilitated completion of my Masters research (Reinsfield, 2012), which considered the drivers for curriculum innovation in technology education and confirmed that governmental agenda and community expectations influenced how the subject was perceived and represented in two school settings. Significantly, the research findings suggested teachers' perceptions of the purpose and nature of their subject differed significantly to my own. So whilst my Master's research focused on how factors such as community expectation influenced a technology teacher's practice, the unanticipated findings led to further interest in teachers' professional identity and its consequent impact on their engagement with and enactment of the official curriculum (MoE, 2007).

More recently, I have worked at the University of Waikato and as a visiting lecturer for pre-service teachers have noticed a diversity of ways in which technology education is represented. I have observed that there appears to be disparity in the ways that the official technology curriculum (MoE, 2007) is interpreted and enacted in different socio-cultural settings. Anecdotal evidence from my Co-ordination role for the national Teacher Education Refresh Programme (University of Waikato, 2016) also suggests that the professional learning structures in place (to support teachers' evolving practice) are variable in quality and sometimes discount individuals' learning needs. The literature also indicates that the ways in which teachers make meaning of their practice can limit, moderate, or enable the development of professional identity (Mortimer & Scott, 2003; Rodgers & Scott, 2008). The next section provides the context for this research.

1.4.2 Background to the research

This section provides some insight into why there may be disparity between policy and practice in technology education. It proposes explanations for why teachers might experience difficulty when interpreting the theoretical concepts in Technology in the New Zealand Curriculum (NZC) (MoE, 2007). These are

described with a view to considering potential influences on teachers' practice when delivering technology education in a secondary school context.

Technology education has seen significant change in its philosophy and content (Williams, 2009). This has, for some teachers, led to a disjunction between Technology in the New Zealand Curriculum as espoused by the Ministry of Education (MoE, 2007) and the practice enacted in some schools. de Vries (2009) suggested that some technology teachers have found a change in thinking and content challenging because they are “practical people who like to do practical things in class” (p. 15). However, the assumption that technology teachers are defined by their practical skills has assured that since its inception, technology education has been expected to rationalise its place in the curriculum, has been undervalued because of its practical nature, and has been deemed to be a subject for less able and unmotivated students (Williams, 2012). It is recognised that such an attitude may still be pervasive in some school communities, regardless of the nature of policy, curriculum, and recommended pedagogy in the New Zealand context. This causes a tension for technology teachers who have to navigate these barriers to teach the official curriculum (MoE, 2007; Reinsfield, 2015).

The practical component of technology education is presented here as a strength of the subject, assuming that it is not the only part of the curriculum that is emphasised. When practical skills are the sole emphasis of learning, there is less opportunity for students to engage in tasks that foster creative and critical thinking. In a political climate where government rhetoric prioritises practical or vocational pursuits, the potential for a future-focused curriculum is less likely to be realised. This climate is described in the next section.

1.4.2.1 The nature of technology education

The National Education Goals (NEG's) (MoE, 2004) in New Zealand encourage schools and teachers to interpret the official curriculum and make decisions about the appropriateness of learning in their school context. The aim for technology education, according to the New Zealand Curriculum (MoE, 2007), is for “students to develop a broad technological literacy that will equip them to participate in a society as informed citizens and give them access to technology related careers” (p. 32). To support this outcome, junior secondary programmes

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generally provide learning that prepares students for senior pathways in schools, and this can influence the way that the official curriculum is enacted.

The tension between preparing students for technology related careers and teachers' enactment of the curriculum has potentially resulted from emerging shortages in areas such as information and communication technology, science, technology, engineering, and mathematics (MoE, 2015a), as well as an immediate societal need to overcome skills shortages in the Trades. Technology education in secondary schools can provide pathways to accommodate a range of workforce needs but by doing so, there can be professional tension for some teachers whose practice is driven by the seemingly conflicting philosophical and academic concepts presented within the official technology curriculum (MoE, 2007).

The complex and sustained relationship between vocational (trades) and (general) technology education suggests a duality between the two philosophical approaches, which are often taught in the same environment, by the same teachers, and to the same students (Williams, 2015). According to Williams, the pragmatics of the subject's enactment can mean that to separate teaching into different concepts or pathways is not always straightforward. Technology education and vocational education have differing purposes and contrasting pedagogical approaches. By blending the philosophies, a teacher can be less empowered to address the concepts presented within the curriculum (MoE, 2007). For example, a teacher who aligns solely with a vocational approach might appear to perpetuate the view that technology education is a means to develop practical skills and accommodate workforce demands (Reinsfield, 2014). Alternatively, technology education can be viewed as a subject that can provide learning opportunities which can accommodate a diverse range of academic and social needs through creative, critical, and problem solving approaches (Reinsfield, 2014; 2016a; 2016b). This is not to suggest that those students who have a preference for practical activities are not creative or cannot solve problems but in my experience, trades pathways can often situate learning as a means for students to manufacture outcomes through a series of pre-determined stages (Reinsfield & Williams, 2017). The tension for technology teachers is how they manage the traditional perceptions of the subject to interpret the curriculum and respond to the

changing context of global, social, and technological need in their classrooms, from a future-focused perspective.

Technology education can be delivered in a variety of ways - as a distinct learning area or within an integrated curriculum model. As a result of practical or conceptual means, teaching can be contextualised to address the learning needs of a diverse group of students. In New Zealand, learning opportunities in the junior secondary school should align with all three strands of the technology curriculum over a period of two years (MoE, 2007). These strands are *Technological Practice*, *Technological Knowledge*, and the *Nature of Technology* (See Section 1.4). The components within each curriculum strand are outlined in Table 1.

Table 1. The eight technology curriculum components

Adapted from the New Zealand curriculum (MoE, 2007)

Technological practice	Technological knowledge	The Nature of Technology
Planning for Practice	Technological Modelling	Characteristics of Technology
Brief Development	Technological Products	Characteristics of Technological Outcomes
Outcome Development and Evaluation	Technological Systems	

A teacher’s engagement with these strands is likely to reflect personally held values and beliefs about the role of education and the purpose of the subject they teach (Alsup, 2006). In the New Zealand context, it is the teacher’s professional responsibility to reflect upon how their teaching facilitates “thinking and practices that are informed, critical and creative” (MoE, 2007, p. 32). Some teachers have found this process difficult however, because of the need for them to align their attitudes with a different conception of the subject (Reinsfield, 2014). It is acknowledged that a need for a change in practice can be received in differing ways, but for some teachers, their response is to perpetuate historically placed practices (Paechter, 1995). The next section outlines the structure of this thesis.

1.5 Structure of the thesis

This thesis is organised into seven chapters. The introductory chapter outlines how my professional experiences led to the research questions and provides a brief overview of the research context, its rationale and aims. Chapter two

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provides a deeper analysis of the research context to offer insight into the nature of technology education in New Zealand. It outlines the influence of political agenda on technology education in secondary schools and describes the features of professional learning and the various influences upon curriculum enactment from a historical and contemporary perspective. International factors affecting curriculum development and enactment and the influence of teacher perceptions are also discussed.

In Chapter three, I describe the conceptual framework defining this research, which is interpretive and qualitative in nature and advocates for a view of reality, as determined by and through the participants' experiences. Socio-cultural theory is presented as a means to conceptualise the cultural, historical, institutional and individual factors influencing technology teachers' professional practice. Three generations of activity theory are introduced, in reference to teachers' meaning making of the curriculum and manifesting practices. Finally the notions of threshold concepts and liminality are described in relation to teachers' professional understandings.

The methodology is described in Chapter four. The research questions are reiterated and my research practice, ethical responsibilities, and quality assurance processes are introduced. The case study approach is discussed in relation to the socio-cultural settings of Lakeside (Hoki Kaipuke) Academy and Greenhill (Pukepuke Matomato) School (Pseudonyms). The six research participants are introduced in relation to their professional experiences. Data were collected in four phases and the methods of collection are described in relation to semi-structured interviews, lesson and department meeting observations, and teacher-generated resources. Finally the data analysis process is presented; the use of Nvivo 11 is identified, and the interpretive framework of activity theory is outlined.

Chapter five presents the findings, as they emerged from the data. It begins with data from the baseline interviews to illustrate that the key concepts defining teachers' perceptions were their values and beliefs, objectives (pedagogical aims), perceived roles, and the discourse of the curriculum. Next, each participant is discussed in relation to their observed lesson and how it aligned or contradicted with their espoused theories. Finally, each school is described in relation to the

observed professional learning. Comparisons are made between the school contexts as a result of the presented data.

Chapter six begins by discussing the emergent themes. Teacher perceptions are identified in relation to the differing interpretations of the technological knowledge characterising the subject, and a propensity to emphasise the *Technological Practice* strand. Teachers' attitudes and ways of engaging with the curriculum are also discussed in this section. Next, teachers' curriculum enactment is described in reference to their emphasis on the *Technological Practice* strand, emerging hesitation to engage with the *Nature of Technology* strand, perceived professional responsibilities, and understandings of the curriculum. The discussion also outlines the implications of the research findings in relation to teachers' evolving knowledge for practice. Teacher perceptions, interpretation, and enactment of the curriculum are then further discussed in reference to a proposed professional learning model. A threshold concept is presented, which aims to highlight the potential for pedagogical change and enable teachers' evolving knowledge for practice. Finally, Chapter seven discusses the limitations, and implications of the research, its key conclusions, and outlines the potential for a future-focused technology curriculum. A brief summary of this chapter is then provided.

1.6 Chapter summary

This introductory chapter began with a problem statement to explain the pertinence of the research. It explained briefly the significant change that has occurred in technology education, which has led to disparity in theory and practice. The tension between the subject's technical roots and opportunities to provide a future-focused curriculum were also described. Teacher perceptions and their engagement with the curriculum were introduced as factors to influence such practice. My background in the technology education community was described to explain my interest and rationale for this research. The structure of the thesis is also provided.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

As identified in Chapter One, technology education is a subject that provides opportunities for students to be exposed to learning about the changing nature of knowledge, technology, society, and global issues through the means of problem solving activities that encourage critical and creative thinking opportunities (Bates, 2001; Education Gazette, 2017; Lai & Hong, 2015; Lewis, Petrina, & Hill, 1998; MoE, 2016b, 2017b; Steeples, Jones, & Goodyear, 2002; Welsh, Wanberg, Brown, & Simmering, 2003; Wright, 2010). The subject's technical origins however, have persistent implications for the contemporary nature of technology education and on the ways that school communities, teachers and students perceive the purpose of the subject in a New Zealand context (Education Counts, 2017; Lombardi, 2007; McLintoch, 1966; Mumtaz, 2000; Peacock, 1997; Prensky, 2008; Reid, 2000; Snape & Fox-Turnbull, 2013). This chapter considers how the literature can provide insight into the perceived disparity between teachers' understanding of curriculum theory and practice.

My methodology for this literature review is defined as *narrative* (Bearman et al, 2012). I used discovery tools (initially EBSCO Summon and more recently ProQuest Primo) because this allowed me to efficiently search across multiple databases at the same time (Brigham et al., 2016; Philp, 2017). I have presented the literature critically and framed the chapter from a macro to micro perspective. There were some sequential strategies used, including identifying the key words in the research questions and using them to frame the inquiry - e.g. curriculum discourse, professional learning, teacher perceptions. These were the inclusion criteria. Exclusion criteria were not predetermined, but negotiated as the inquiry evolved. Systematic synthesis of the key concepts were recorded in a database, with categories and correlations between literature maintained according to the extraction of relevant data.

The review considers the international trends that have influenced national curriculum development and asserts that the focus for implementation in New Zealand has hindered teachers' evolving understandings of the ways that concepts can be applied to their classroom practice (Alcorn & Thrupp, 2012; Ferguson,

1993; Hill, 2003; Jones, 1997; Jones, et al., 2013; Jones & Compton, 2009; Owen-Jackson, 2013; Reid, 2000; Williams, 2013). Teachers' perceptions are discussed in reference to their epistemological and ontological values and to consider their impact on professionals' identities in technology education (Compton & Jones, 2004; de Vries, 2005; Holland, Lachicotte, Skinner, & Cain, 1998; Jones, 1997; Packer & Goicoechea, 2000; Perkins, 1999; Williams, 2012).

The ways that a school's discourse can affect how a teacher interprets or enacts the curriculum is considered in this chapter (Darling-Hammond, Chung, & Frelow, 2002; Gee & Green, 1998; MacGregor, 2017; Roche & Marsh, 2000; Shavelson, Hubner, & Stanton, 1976; Williamson, 2013). The chapter concludes with discussion about the professional learning context in New Zealand (Aminudin, 2012; Blackmore Bateman, Loughlin, O'Mara, & Aranda, 2011; Johnson, 2011; MoE, 2016c).

2.2 Curriculum policy and practice

There are differing perceptions of the role of education. Adler (1982) for example, suggested three aims for schooling, which included developing citizenship, personal growth, and occupational preparedness. Alternatively, the purpose of education has been closely linked to social and economic outcomes, or a need to develop mathematical and reading skills, the assimilation of immigrants, job preparation and the development of social and moral responsibility (Tyack, 1988). In New Zealand, the Ministry of Education (2014) states that the educators should aim to

... Lift aspiration, [and] raise educational achievement for every New Zealander by remaining strong in national and cultural identity, aspire for more, providing choice and opportunity, fostering learners who are active participants, citizens within a strong civil society, so that the country can be productive, valued and globally competitive. (paras. 1 & 2)

For technology education, there is a tension for how the subject can contribute to this vision. The perceived role of technology education is likely to be reflected through teachers' engagement with the curriculum and their resulting practice, which in turn will impact on students' experiences in the subject and the skills and knowledge that result (Reinsfield & Williams, 2017; Williams, 2013). Technology education can encompass a variety of interpretations of its role, yet

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manifesting pathways have the potential to perpetuate a class system, which therefore impacts on the subject's perceived status (Hill, 2003). For example, the direction that a practitioner takes when teaching technology education should be inclusive of the curriculum requirements yet also respond to student interest. In many New Zealand schools however, there is an expectation that both vocational and general technology pathways should be accommodated, often in the same classroom (Reinsfield & Williams, 2017). The challenge for teachers is how they can manage any tensions that this might cause for their practice. Some teachers might be unable or unprepared to challenge this discourse and consequently offer programmes that embrace governmental incentives or direct youngsters into a Trades pathway. There is a risk here that learners are better suited to a career in technology (such as food technology), but they are not necessarily provided with this choice.

In New Zealand, the government's agenda is regularly assessed against future workforce needs and there is a current skill shortage in professions like engineering, information and communication technology (ICT), electronics, hospitality and tourism, as well as the Trades (New Zealand Immigration, 2016). There is a particular shortage of skills in the Canterbury region in construction, engineering, ICT and electronics, trades and transport (New Zealand Immigration, 2016). The 2011 earthquakes (for example) led to an estimated rebuild cost of around \$40 billion, and the government was required to develop local strategies to address a deficit of skilled builders (Stevenson et al., 2014). The demand for builders has also been perpetuated by a lack of affordable housing in Auckland and the government's commitment to build 70,000 new homes (New Zealand Treasury, 2016).

When issues around a national skills shortage are emphasised in the media, teachers of technology education are likely to experience professional conflict if their understanding of the subject's purpose contrasts with governmental rhetoric about the need to respond to workforce demands (Reinsfield, 2014). The establishment of Trades Academies in 2011 and the introduction of the Youth Guarantee Scheme in 2013 (Tertiary Education Commission [TEC], 2014) suggested a political emphasis on vocational pathways in New Zealand. This

reflects a trend observed by Young (1998) who argued that the educational framework in the United Kingdom was dominated by the attempts of

... Successive conservative governments to maintain divisions between academic and vocational learning [to] siphon off as many young people as possible into vocational education and training programmes thus excluding them in effect from access to understandings they would need in the future as adults in an increasingly complex and uncertain society. (p. 2)

As a result of such professional tensions, some teachers might question or seek to validate their own interpretation of the nature of technology and consequently reflect upon, maintain, or retreat to previous professional practices that are vocationally orientated (Paechter, 1995).

2.2.1 The New Zealand curriculum

Government policy encourages teachers in New Zealand to be legitimate curriculum decision makers (MoE, 2007). The tensions that exist between policy (in this case the curriculum) and practice are socially organised and mediated by teachers' perceptions of the nature of technology education and their understanding of professional praxis. These tensions can be explored through the study of relationships between discourse, social settings, the learning that occurs, and attributed meaning (Gee & Green, 1998). An official curriculum outlines practices that carry specific meanings and importance within a society, and it reflects a country's social, cultural, political, and economic discourse to determine what is considered as "official or legitimate knowledge" (Williamson, 2013, p. 16). How this knowledge is communicated can be explained through reproduction theory.

2.2.1.1 *Reproduction theory*

Reproduction theory asserts the view that social groupings and culturally defined behaviours can communicate the meaning behind a manifesting practice (Kanjanoobtra & Corbitt, 2016). Policy can be seen as a means to structure or define education, which can be contested, reconceived or refined through practice (Ball, 1987; Peszynski & Corbitt, 2006). Accordingly, those in positions of power inevitably subjugate others (who may or may not be oppressed) to maintain the dominant discourse and protect their place in a community (or society) (Giroux, 1983).

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When exploring teachers' perceptions and practice the concept of habitus and cultural capital are of interest, because they can support understanding about the social characteristics of an individual, as they manifest through their habits, skills, or dispositions, and as the result of their lived experiences (Bourdieu, 1979, 1986). Such thinking is pertinent when exploring whether teachers' practice is limited, moderated, or enabled by their previous professional experiences (MacGregor, 2017).

In the New Zealand context, there is an aging demographic of teachers, who might be more likely to associate the subject with its technical roots and adopt a traditional approach to its enactment (Education Counts, 2017; Mumtaz, 2000; Prensky, 2008). In a secondary school context, meaning could be interpreted as the result of professional, parental or students' cultural capital (Sullivan, 2001). Cultural capital can be represented in three forms - through the dispositions of mind and body, through cultural goods in an objectified state (such as teacher-generated resources), and through institutional discourse (Bourdieu, 1986; Gunn, 2005). For example, secondary students may come to class with the expectation that they will only do practical work because this is what their parents described the subject to be, or parents might attribute value to the development of a well-made outcome. The tension with this thinking is that it is not reflective of the nature of the subject, as it is conceptualised within the current New Zealand curriculum (MoE, 2007).

As a policy document, it could be assumed that the curriculum would define the nature of technology education in New Zealand. There appears however, to be a disparity in the way that technology teachers view the purpose of their subject, which is at times contrary to the curriculum and aligns more with their own professional experiences or previous iterations of curriculum policy. In the case where teachers have been trained overseas, there might also be conflict between a school's discourse and their own cultural interpretations (Kostogriz & Peeler, 2004).

In this case, de-contextualisation or re-contextualisation might be a strategy used by teachers to make meaning of the curriculum. When there is a dominating power however, there is the potential for teachers to be reluctant to engage with new conceptualisations of praxis (Ryan, 1984). Resistance to change might be

motivated by the perceived negative implications on students' learning outcomes, to which teachers are likely to be held accountable.

2.2.1.2 A hidden curriculum

Academics have discussed the unintended but emerging consequences of a political text, which can lead to a hidden curriculum in a school (Apple, 1988; Giroux, 1983; Giroux & McLaren, 1986; Pinar & Bowers, 1992; Pinar, Reynolds, Slattery, & Taubman, 1995). A hidden curriculum can influence the ways that knowledge is socially constructed, and in turn how the dominant discourse determines practices in a school context (McLaren, 1989). The hidden curriculum can manifest as “norms and values that are implicitly, but effectively, taught in schools and that are not usually talked about in teachers' statements of end” (Apple, 2004, p. 78). In the case of technology education, there is the risk that despite suggestions otherwise, teachers might be promoting practical and skills based activities instead of the notions advocated for in the current curriculum (MoE, 2007).

The purpose of the New Zealand curriculum (MoE, 2007) was to establish the direction for student learning in schools, to provide guidance, and allow schools to shape pedagogy in their context (MoE, 2007). The drivers for change were to “build an education system that equip New Zealanders with twenty-first century skills and to reduce underachievement in education” (Cubitt, 2006, p. 196). Cubitt argued that a Curriculum Stock-take Report indicated education in New Zealand should refocus on developing human capability, with a view to supporting the structure of a prosperous and inclusive society (Le Métais, 2002). The report also stated that the curriculum should be reviewed in light of teachers' workload issues, and that there should be more explicit connections made between learning, pedagogy, and assessment. Teachers in New Zealand are positioned as empowered professionals and legitimate decision makers who are able to design appropriate learning for *their students in their school context* (Le Métais, 2002).

There were several new directions within the New Zealand curriculum (MoE, 2007), but pertinent to this research is the emphasis on learner-centred pedagogies. Learner-centred pedagogies can be traced back to Dewey, who theorised that the nature of education should be responsive to the school's

students and community (Brough, 2008). From Dewey's perspective (1936, 1986, 2004), schools should be democratic environments where learners are enabled to work together to solve real-life issues in order to become contributing members of society. For students to gain the most from their learning in technology education, outcomes should be authentic in nature, about real-world issues, and negotiated with or determined by them.

2.3 The role of technology education

Technology education (which is known as Design and Technology in some countries) has evolved as a subject in its own right in Australia, Canada, Europe, New Zealand, South Africa, the United Kingdom, and the United States of America (Jones, 2009; Jones, et al., 2013). Each country has developed localised responses, which result from its economic and social situations but all emphasise the need to develop students' technological literacy (de Vries, 2013). A technologically literate citizen is someone who "understands, in increasingly sophisticated ways that evolve over time, what technology is, how it is created, how it shapes society, and in turn is shaped by society" (International Technology Education Association (ITEA), 2007, p. 9). The next section describes the recent evolution of technology education because since its inception, curriculum development in New Zealand has been influenced by international trends, and in particular the curriculum in England (Jones & Compton, 2009; Reid, 2000).

2.3.1 The evolution of technology education

Technology education does not have a long tradition in comparison to some other areas of the curriculum; its evolution is culturally specific and there continues to be disparity in the interpretation and philosophical understanding of its role - particularly in the secondary school curriculum (Hill, 2003). Hill considered the subject's dual role beneficial because of the potential to foster vocational craft skills and/or academic thinking. In countries like the United States, where technology education has been established for a number of years, there are still barriers to its enactment, including the way it is perceived to suit a particular audience, such as lower ability students. Another cited barrier to curriculum enactment is the quality of teaching, which must be addressed before an intended curriculum can be realised (Rasinen, 2003). To illustrate how such a diverse discipline translates into the secondary school context, the aims for the technology

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curriculum in three countries, Canada, England, and New Zealand are outlined in Table 2. In Canada, there is no centralised curriculum - there are 13 individual jurisdictions across the country (OECD, 2015). Technology education was introduced in the 1970's. Whilst the subject was apparently endorsed by the 1980's, change was slow to occur and vocational programmes were retained until the 1990's when their number declined (Hachè, 2006). In the 1990's, barriers to curriculum enactment included budgetary issues and the availability of qualified technology teachers. There was increasing interest in technology education, but a concern that the use of computers would be overemphasised in the curriculum (Sharpe, 1996). During this decade, a constructivist approach was cited as being vital to the teaching of Technology Education in Canada. Vocational programmes became less prominent (Hill & Smith, 1998).

During the early 2000's computing was perceived to be the predominant type of technology education needed but technology education was generally not considered to be an avenue to enable this (Milton, 2005). Technological literacy was rooted in the skills development needed by rapid growth of this Canadian economy at the time (Chinien, Oaks & Boutine, 2002). Since 2010, curriculum development appears to have been driven by the competencies students are deemed to need to live, learn and work. The underpinning concepts include ways of knowing and personalised learning, breadth and depth, interdisciplinary learning, flexible approaches, a responsive curriculum suitable for the Digital age (Ministry of Education, 2009).

Table 2 shows that how the three curricula identify the subject's role in preparing students to function in society as future citizens who can think creatively and critically to respond to technological advances in an evolving society.

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Table 2. Curriculum aims in three countries

	Canada	England	New Zealand
	Technological Education (Ministry of Education, 2009; Revised 2017)	Design and Technology (Department of Education, 2013)	Technology Education (MoE, 2007; Revised 2017).
Curriculum aims	<p>A creative and flexible approach to problem solving that will assist in everyday life.</p> <p>Develop the skills required to do research, conduct inquiries, and communicate findings accurately, ethically, and effectively;</p> <p>Develop lifelong learning habits to adapt to technological advances in a changing workplace and the world.</p> <p>Understand how to take advantage of post-secondary educational and work opportunities.</p>	<p>Develop students' creative, technical and practical expertise to function in life and an increasingly technological world.</p> <p>Foster knowledge and skills to design and make quality outcomes for different users.</p> <p>Critique, evaluate and test ideas and products, and the work of others.</p> <p>Understand and apply the principles of nutrition and learn how to cook.</p>	<p>To develop a broad technological literacy</p> <p>To enable participation in society as informed citizens</p> <p>To enable access to technology-related careers</p> <p>To learn practical skills and develop models, products and systems.</p> <p>Learn about technology as a human field of activity, and explore historical and contemporary examples, from a variety of contexts.</p> <p>There is an association with the transformation of energy, information and materials.</p>

A review of literature, which focused on the impact of Design and Technology in schools in the United Kingdom revealed that the subject had evolved significantly since it was introduced in 1990, but also suggested that there was a lack of evidence to substantiate how it benefited students' learning (Harris & Wilson, 2003). In the late 1980's, the Parke's report (1988) advocated for design and technology (D&T) to focus on capability and perspectives that encouraged students to understand the consequences of a technological activity. During this time, teachers' experienced difficulty with the new conception of the subject and student achievement declined because assessment focused on what they could *do* with knowledge, not on the knowledge that they had. Achievement descriptors focused on procedural competence and this became highly significant to learning in design and technology (Barlex, 2018).

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Design and Technology was revised in the 1990's and purported to be more flexible and broader in nature (Department of Education (DoE), 2013). At the Technology Education New Zealand Conference (TENZ), Barlex (2015) described a subject that was “established as a purposeful learning area...[that] takes place within a context of specific constraints and depends on value judgments at almost every stage” (para. 3).

More recently, the design and technology curriculum was described by Choulerton (2015) as consisting of heavily guided practical tasks, leaving few opportunities for designing in 3D. She suggested that in design and technology, there were few opportunities for learning in an iterative manner, and students are often doing the same projects that their parents did. Choulerton asserted that teacher numbers were low, cited a need for significant curriculum professional development, and concluded that key stakeholders did not understand the subject.

Barlex (2017) indicates a significant and continuing need for professional development, to focus on specialist knowledge and pedagogy, and with a view to modernise the curriculum area's profile. He describes an outdated subject where students are often doing the same projects that their parents did and where key stakeholders do not understand its purpose. It is proposed here that this may also be the case in some secondary technology education classrooms in New Zealand.

The outlined concepts in Table 2 suggest that it is important for educators to be cognisant of their role in preparing students for their positions in a future-focused workforce. Barlex (2016) predicts that there are four potential outcomes that could result from the new curriculum in England (Department of Education, 2013). These are outlined in Table 3.

Table 3. Four potential outcomes for the curriculum in England
(Barlex, 2016)

	The nature of the subject	Application	Resource needs
Outcome 1	The subject is modernised - becomes vocational in nature	Would apply to minority of students and teachers	Upgrade in school facilities Small scale professional development
Outcome 2	The subject does not modernise - becomes vocational	Focuses on handicraft and applies to a minority of students and	Minimal need for facility upgrades and professional development

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	in nature	teachers	
Outcome 3	The subject does not modernise - part of a general education for all	The majority of students and teachers would be involved in handicraft	Minimal need for facility upgrades and professional development
Outcome 4	The subject modernises - part of a general education for all	The majority of students and teachers would engage in a future-focused curriculum	It would require an upgrade of school facilities and professional development on a large scale.

The curriculum development in these two countries can provide insight to how the curriculum might be influenced in the New Zealand context. For example, the way that the curriculum is conceived can influence the way that it is interpreted by teachers and enacted in the classroom. For example, assessment processes can determine what becomes valued knowledge in a community, or government priorities, like an emphasis on digital technologies can diminish other areas of technological knowledge. This potential is pertinent in New Zealand, because of the recent revision to the technology curriculum (See Section 2.3.3.1).

Regardless of the way that the subject is conceived, in New Zealand, technology education should be available for all students and taught in a manner that accommodates their academic or social need (Reinsfield, 2014, 2015, 2016). In Table 3, Outcome four best represents the potential for technology education to support the development of skills and knowledge needed to function in a society that is future-focused. In New Zealand there is a tension between policy and practice, and any of the above outcomes could manifest in teachers' classroom practice for a variety of reasons. There are a number of constraints for teachers committed to the teaching of a future-focused curriculum in an uncertain climate of technological development. In England, limitations include the availability of resources and access to professional development (Barlex, 2017). The parallels between the evolution of the English and New Zealand curriculum are further described within the next section.

2.3.2 Technology education in New Zealand

To represent the subject's nature in New Zealand, it is important to consider how it has evolved since its inception, as well as to review some of the influences that impact upon interpretation and enactment in the secondary school setting. Technology education provides unique opportunities to engage students in their

learning through conceptual and practical means (Hill, 2003). All knowledge types are important within differing learning contexts, to enable students' understanding of the nature of technology education. The role and status of technology education has evolved, but its cross-disciplinary nature means that there is no single theoretical perspective that can define it (Pacey, 1992). Regardless of how it is defined however, technology education can expose students to knowledge that is developed as the result of working with materials, through the development of a concept or outcome, and in response to an identified problem, need, or opportunity (Ferguson, 1993; Hill, 2003). The way that this learning occurs should be considerate of students' interests and the official curriculum (MoE, 2007) and not determined solely by the teacher, community perceptions, or political agenda (Reinsfield & Williams, 2017).

2.3.2.1 The subject's formative years in New Zealand

New Zealand's schooling system has been heavily influenced by colonisation and a British philosophy (Reid, 2000). British public school structures were often adopted with many secondary schools reflecting elitist perspectives, and endorsing the view that the working classes were pre-disposed to more menial tasks. In 1905, the first New Zealand based technical school was opened, which offered practical subjects for those students who were deemed unsuitable for the academic nature of secondary schooling and directed these individuals towards the trades (McLintoch, 1966). Such an attitude reflected the philosophy of England and Wales where technical education was historically aligned to economic and political agenda as well as to employment (Reid, 2000). This attitude continues to be pervasive in New Zealand, and technology education is regularly positioned as a subject that can cater solely to the needs of lower ability students rather than to accommodate a diversity of academic and social learning approaches (Williams, 2013).

During the 1980's in New Zealand, the government endeavoured to de-centralise the power and resources in education. This political move was presented as an opportunity for educational professionals to become more empowered and to enable the transformation of the system to improve both social and academic outcomes for students. The supporting Picot (1988) and Tomorrow's Schools (Lange, 1988) reports reflected instead an increasing influence of the Treasury on

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educational policy, which translated to a context where, “recent official policy discourses on student achievement have stressed the importance of teachers and the impact that effective teaching can have on student life chances and on national economic performance” (Alcorn & Thrupp, 2012, p. 107). The challenge for teachers in such a climate is how to manage any disparity that may be caused as a result of political drivers. In technology education, there is the risk that teachers will retain existing thinking or default to past practices, which perpetuate stereotypical and traditional perceptions around the nature and position of the subject.

In 1995, the New Zealand curriculum (MoE, 1995) aimed to establish technology education as a core subject rather than a means of occupational training. Ferguson (2010) stated that, “from the outset, technology was seen as something distinct from technical education, [e.g. workshop, craft and home economics]” (p. 6). This curriculum reduced the emphasis on the acquisition of technical skills and focused on developing students’ understanding of factors that influenced the process of manufacturing. This iteration of the curriculum (MoE, 1995) centred on the notions of technological knowledge, problem solving, and citizenship. The attempts to counter a traditional view of technology education, raise its academic profile, and generate new understandings of its purpose appeared limited in their effect. The subject remained technician in nature and traditional pedagogical approaches persisted (Biggs, 2006). Despite community recognition that some teachers had found the change in curriculum difficult to navigate, the new technology curriculum (MoE, 2007) then consolidated the epistemological shift, which had begun in 1995. Conceptually, technology education became a subject that recognised the theoretical and conceptual dimensions connecting the different specialist areas that had both technical and vocational beginnings.

Technology education in New Zealand is distinct from other countries because curriculum development has historically focused on the nature of its content rather than the means in which it has been communicated to practitioners for implementation in their classroom (Williams, 2013). During its conception, writers of the current New Zealand curriculum (MoE, 2007) consulted with teachers to trial the newly proposed strands in differing school contexts, reflective of a collaborative approach to curriculum development. The technology

curriculum (MoE, 2007) that resulted saw the emergence of two new strands, *Technological Knowledge* (TK) and the *Nature of Technology* (NoT). These strands were indicative of a re-positioning of the subject because they recognised that knowledge could be drawn from a range of disciplines to inform the production of technological outcomes or systems. This curriculum more explicitly acknowledged the relationship between technological development and society, either historically, in the present day, or in the future (MoE, 2007). From my perspective, the focus on the nature of technology provided an opportunity for teachers to consider how learning contexts might enable students' creative, innovative, and future-oriented thinking.

During its implementation, teachers' understandings appeared to connect with the curriculum's representation of *Technological Knowledge*, perhaps due to its association with the subject's technical origins. The *Nature of Technology* strand however appeared too far from practitioners' professional experiences for them to be able to make any meaningful connections between the curriculum content and their practice (de Vries, 2005; Fox-Turnbull & Sullivan, 2013). Teachers may have engaged less with the *Nature of Technology* strand because the content was disparate to their own personally held ontological and epistemological perceptions (Compton & Jones, 2004; de Vries, 2005; Packer & Goicoechea, 2000; Perkins, 1999). The next section discusses the subject's overarching aim to develop students' technological literacy.

2.3.3 Technological literacy in New Zealand

In their review of technology education in New Zealand, Jones and Compton (2009) indicated that international research trends and policy thinking, rather than teachers' existing or consolidated understandings and practices influenced curriculum change. Technological literacy is a concept that underpins international and the current New Zealand curriculum (Dakers, 2016; de Vries, 2006; Feenberg, 2006; MoE, 2007; Wallace & Hasse, 2014). Technologically literate young people

Have a broad understanding of how and why things work; understand how technological products and systems are developed; critically evaluate technological developments and trends; design and evaluate their own solutions in response to needs and opportunities (Technology Online, 2010a, para. 2).

Technological literacy can also be viewed as a means to support students to function in a technological and future-focused society (Rose, 2007, p. 35). Future-focused practices are defined here as being inclusive of digital pedagogies, learner-centred in nature, and designed to emphasise critical and creative thinking in a variety of ways. The *Nature of Technology* strand of the technology education curriculum (MoE, 2007) provides the opportunity to focus on the reciprocal relationship between technology and society because it

- 1 Considers technology from a historical perspective or as socially constructed in nature
- 2 Can be used to provide learning, which focuses on the development of technologies and techniques that apply in our constructed world, to encompass the processes, ways of thinking, and organisation of socio-technological contexts
- 3 Provides a generic context for specialist areas (like textiles) within technology, which have alternative connotations associated with the learning.
- 4 Accommodates dynamic learning to enable students' participation in a developing global and digital community (Dakers, 2016; de Vries, 2006; Feenberg, 2006; Wallace & Hasse, 2014).

This research explores how these factors manifest within teachers' practice in technology education.

2.3.3.1 Emerging links between digital and technological literacy

The current iteration of the New Zealand curriculum (MoE, 2007) has been revised to further emphasise digital technology as a technological area (MoE, 2017b, 2017c). The changes to the curriculum are illustrated in Figure 1.

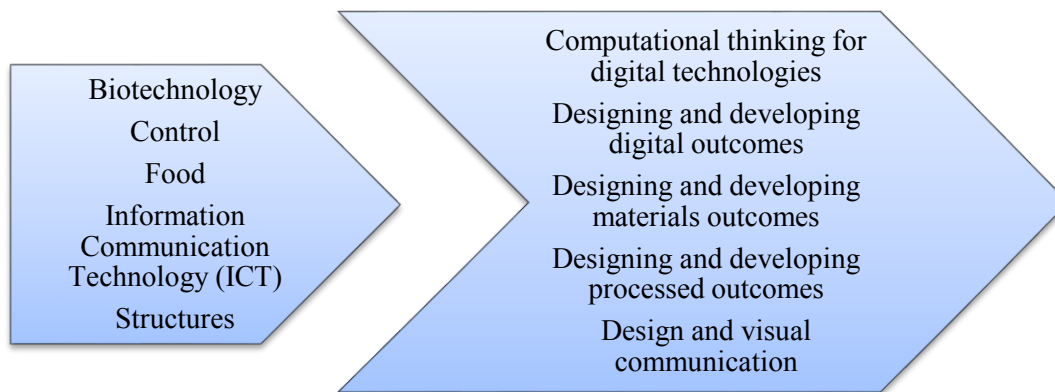


Figure 1. The technological areas in the revised New Zealand curriculum (MoE, 2007, 2017b).

Increasingly, the success of students as citizens is associated with their digital literacy (Berson & Berson, 2013; Education Gazette, 2017; Koltay, 2011; MoE, 2017a, 2017b; Pangrazio, 2014). Digital literacy is defined here as the skills and proficiency in the use of digital tools and as a means to assimilate information, evaluate, and reintegrate it (Glister & Glister, 1997; Jones & Hafner, 2012; Lankshear & Knobel, 2011; Thorne, 2013). To support students’ engagement with technology education however, there is a need to develop their digital fluency, not just their literacy. Someone who is digitally literate has the capacity to use digital tools whereas digital fluency is demonstrated when a person makes deliberate choices about the use of those tools for a specific purpose (Attwell, 2007; MoE, 2017c; Prensky, 2012; Wenmoth, 2016; White, 2013).

Digital technology, like the other learning contexts in technology has evolved from being viewed as technical (traditionally typing) to include a wider focus, which is future-focused in nature (Bates, 2001; Steeples, et al., 2002; Welsh, et al., 2003; Wright, 2010). Technology educators are now being positioned with an expectation that they model the use of digital tools in their classroom (MoE, 2016b). This is not without its challenges for some practioners who appear to be already struggling with the way that the subject is conceptualised.

Most secondary school students will have grown up with digital technology as an integral part of their lives (Nikirk, 2009) and as Prensky (2001) stated “Our

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students today are all “native speakers” of the digital language of computers, video games and the Internet” (p. 1). There is a view however that students’ ability to engage with technology for personal reasons (e.g. Social media on their mobile phones) does not necessarily translate into *Technological Knowledge* (MoE, 2007) or for the purposes of their education (Becker, 2000; Bennett, Maton, & Kervin, 2008; Cuban, 2001; Lai & Hong, 2015; Lorenzo & Dziuban, 2006; Ng & Nicholas, 2013; Romeo, 2006; Wright, 2010). The use of digital technologies needs to be responsive to the learning focus, students’ familiarity, or availability of resources (Bullen, Morgan, & Qayyum, 2011; Kennedy, Judd, Dalgarno, & Waycott, 2010; Lai & Hong, 2015; Oh & Reeves, 2007; Selwyn, 2009). This is also a potential tension for teachers who are required to become both digitally fluent and responsive to student need, to enact the curriculum (Levin & Arafeh, 2002; Prensky, 2005).

Teaching in the future will look very different, with virtual and “on demand” teaching approaches becoming commonplace (Nikirk, 2009). Whilst such trends can already be observed in secondary schools, the capacity for digital learning in New Zealand remains dependent upon funding issues, organisational structures and teacher capability (Melhuish, & Falloon, 2010; Mumtaz, 2000; Wright, 2010). Wright and Forbes (2015) consider the pedagogical constraints in this climate and argue that teaching and learning should focus on learner agency and active engagement within an environment that encourages collaboration, creativity, risk-taking, experimentation and inquiry. Such an approach, they argue, means that the status quo can be challenged. I agree with their perspective and believe that for change to occur in technology education, teachers should embrace the use of digital pedagogies to enable learning that is motivated by their students’ interests and capabilities.

The *Nature of Technology* strand might be enacted through digital technology by exposing students to the ways that computers have evolved, and affect society with a view to develop critical awareness of what it means to live and interact with a technologically mediated world (Dakers, 2006; MoE, 2017b). It is likely in some schools however that learning in technology education is minimised to the skills and knowledge required to replicate a technological system rather than its social or cultural affect (Williams, 2015). To become technologically fluent,

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students need to understand the relationship between technology and society. As Dakers (2006, p. 1) asserted,

...We are transforming our world at an alarming rate and in so doing we are alienating ourselves from it. Our technologically mediated existence is threatening the very democratic process itself. We need to develop a new language, a new literacy, in order to both understand our brave new world, and learn how to live a meaningful existence in it.

The transformative nature of technology means that it is challenging to anticipate or define the type of future-focused learning to which students should be exposed in a classroom. Some teachers are likely to revert to trusted content because they are confident that by doing so, they are more likely to address the curriculum requirements. Instead, teachers could be focusing explicitly on the concepts and principles that pertain to technology and its ever-evolving place in society (ITEA, 2007). Technology education can be taught by providing learning contexts that investigate craft, industry, science, hi-tech, engineering, key competencies or design approaches (Hill, 2003). Concepts within these learning contexts can include technical performance and processes, disciplinary knowledge, conceptual approaches to problem solving, the reproduction of real-world contexts, and responsive pedagogies that are personalised, learner-centred and determined by students' interests (Zuga, 1989). In New Zealand, teachers also identify in their planning, how students' learning addresses the curriculum's key competencies.

The addition of "key competencies" to the national curriculum (MoE, 2007, p. 12) resulted from the Organisation for Economic Co-operation and Development's (OECD) Definition and Selection of Competencies (DeSeCo) project (OECD, 2005). The DeSeCo report emphasised the need for students to have an active role in their education and proposed that by embedding future-focused competencies into their learning, students would be more likely to use them in order to shape society. The key competencies identified in the New Zealand curriculum are thinking, using language, symbols and text, managing self, relating to others, and participating and contributing (MoE, 2007, p.12). There appear to be two key competencies that align with this future-focused research context although all are relevant to a holistic approach to technology education. The first key competency of pertinence is "thinking", described as "using creative, critical and metacognitive processes to make sense of information, experiences and ideas"

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(MoE, 2007, p. 12). The second is the “participating and contributing” competency, which encourages attention to “the roles, and responsibilities... contributing to the quality and sustainability of social, cultural, physical, and economic environments” (p. 13). Both of these competencies can provide a context for teachers to focus students’ learning on the relationship between technology and society.

There are explanations for the ways that technology and society intersect that can be explored through the differing extremes of technological determinism (Pacey, 2001). The first perspective assumes that technology is autonomous in nature and likely to evolve regardless of human intervention. The second is that it can be used to provide a context for social control (Dafoe, 2015; Wyatt, 2008). The evolution of technology is inevitably shaped by societal need or demand (Dafoe, 2015; Potts, 2008). There is also a political dimension, consisting of “hardware, practical skills, technical knowledge...organisational... and cultural aspects connecting values and beliefs” (Pacey, 2001, p. 7). Technological determinism can be used to reflect the differing trends in socio-technological evolution and ways of thinking about technology (Bijker, 2010; Dafoe, 2015; Hughes, 1987; Winner, 1980, 2010). Table 4 identifies that there are differing perceptions of the nature of technology, which indicate a range of potential learning opportunities for developing students’ technological literacy.

Table 4. Ways of perceiving technological determinism

Perspective	Artefactual determinism	Technical determinism	Technological politics	Technological momentum	Technological frames
Example	Artefacts shape societal relationships with technology	The discourse in a social setting influences societal engagement with technology	Technologies reflect intentions, which in turn influence societal interactions with technology	As technological systems become established, people are less likely to critique their use in society	Socially constructed practices can constrain creative approaches to innovative technological development

Exposing students to a range of differing perspectives about technology is likely to require a change in teaching and learning for some teachers, to accommodate the

...Rapid pace of technological advancement and global connectivity [which] has prompted further calls mandating the revision of current education practices to meet and shift futurist predictions and ideals about how young people prepare for and engage with their futures. (Cowie & McNae, 2017, p. ix)

The next section describes the emergence of Innovative Learning Environments in New Zealand, and the opportunities that this presents for a changing pedagogical climate.

2.3.4 A changing pedagogical climate

The emergence of Innovative Learning Environments (ILE's) has led to a focus on the ways in which teachers can develop their pedagogical responses to accommodate students' learning needs. School structures are changing because "a new way of designing and delivering a curriculum is required" (Leggat, 2015, p. 13). In this learning context, curriculum models can be integrated or interdisciplinary, responsive to students' interests or inquiry based (OECD, 2012). The benefits of an integrated approach can include a more coherent education, where students can be encouraged to make connections between different subjects and learning can be negotiated to increase active involvement (Etim, 2005; Fraser, 2000). Such an approach requires teachers to collaborate across curriculum areas when planning and responding to student need and there is a risk that a teacher might be positioned to anticipate rather than respond to student learning, limiting the potential for learner agency (Beane, 1997; Virtue, Wilson, & Ingram, 2009). A correlation between the ILE model and improved student outcomes has been made in the literature, as the result of inter-disciplinary, collaborative approaches to teaching, but only where there was sustained professional learning and supportive school structures (Blackmore Bateman, et al., 2011; Darling-Hammond, et al., 2002; Osborne, 2016).

With a continued global emphasis on technological innovation and an increased awareness of the impact of technology on society, it might be reasonable to assume that technology education has an established role in schools to lead interdisciplinary learning (Reinsfield & Williams, 2017). In this case, there is the potential that learning could address both the *Nature of Technology* and *Technological Knowledge* strands of the New Zealand curriculum (MoE, 2007). The means to enable future-focused approaches to learning is influenced by the

school context and government policy in an ever-evolving educational climate. Policy documents, like the New Zealand School Property Strategy (MoE, 2011), assert that ILE's are a means to develop "a world-leading education system [able to provide] all New Zealanders with the knowledge, skills and values to be successful citizens in the 21st Century" (p. 2). This view suggests that all students' needs should be addressed in this context - not just those that cater to immediate societal or workforce pressures.

There are various factors that are fundamental to the successful implementation and enactment of innovative and responsive educational practice however. Innovation in teaching for example, can be represented through an increased engagement in differing pedagogical practices, which include authentic or real-world learning opportunities for students that result from engagement in personalised programmes (OECD, 2014). Technology education has the potential to accommodate such learning opportunities, but to facilitate this there might be a need for some teachers to change their beliefs about the purpose of the subject.

Educational change is a complex process where curriculum implementation might occur through sufferance, and teachers can be suspicious of reform (Handal & Herrington, 2003). In this context, when practitioners come to enact the curriculum in their classrooms, they are likely to rely more heavily on their own beliefs than on currently advocated pedagogical approaches. Change can be further limited when there is a reliance on professional learning processes, which familiarise practitioners with content rather than encourage reflection about their perceptions or the effectiveness of their practice (Williams, 2013).

2.3.4.1 Effective pedagogy

The notion of "effective pedagogy" is presented in the New Zealand curriculum (MoE, 2007, p. 34). It states, "there is no formula that will guarantee learning for every student in every context" (MoE, 2007, p. 34), that students learn best when they feel supported and safe in their school or classroom. Teachers are encouraged to reflect and consider their own actions, understand the focus of the learning, to support students' collaborative practices, recognise their experiences, and offer substantive learning opportunities.

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Teachers in New Zealand are encouraged to inquire into their practice and be adaptive in their teaching approaches (Timperley & Alton-Lee, 2008). However, opportunities for the enactment of contemporary pedagogical approaches can be mediated by the school's context. For example, there are likely to be differing community expectations if a school has a reputation for its traditional approach to learning in contrast to a school that advertises itself as an ILE. Community expectations also have the potential to enable, moderate or limit teachers' innovative practices (OECD, 2012; Reinsfield, 2012).

Education has traditionally focused on the development of students' competencies, in particular their understanding of knowledge and skills. It should also develop students' capability to adapt to a changing world where new knowledge is generated (Fraser, 2000). To foster a climate of innovation in technology education, teachers are likely to be required to encourage creative and critical thinking and reflection about the factors that can inform future technological developments. Such practice is significantly different to teaching students about the stages of production in a replicated product, and it signals a need to foster a learner-centred classroom.

2.3.4.1.1 Learner-centred classrooms

Learner-centred approaches to pedagogy are identified in the New Zealand curriculum (MoE, 2007, pp. 34 - 40). There has been considerable attention paid to this pedagogical approach internationally because it supports a democratic and responsive style that can recognise students' academic interests and needs (McCombs & Whisler, 1997; Onchwari, Onchwari & Keengwe, 2009; Tabulawa, 2003; Windschitl, 2002). Also, these approaches encourage students to take responsibility and engage in critical and authentic learning (Novak, 1998).

A learner-centred perspective allows a teacher to acknowledge students' worldviews, as represented by their knowledge, skills and cultural locatedness, which is valued in the New Zealand context (McCombs & Whisler, 1997). Cultural locatedness is a concept that is used in New Zealand to describe the concept of *Tangata Whenuatanga*, which affirms Māori learners (NZEC, 2011). This notion aligns with the view that there should be the provision of contexts for learning where the identity, language, and culture of Māori learners is affirmed.

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With this concept in mind, it is argued that by catering for individuals' interest, learners are more likely to become self-regulated and increasingly creative and innovative in their technological practice.

Self-regulated learners are confident, diligent, and resourceful; they know what they can do and are proactive to seek support, as they require it (Zimmerman, 1990). Zimmerman argued that self-regulated learners can problem-solve, take responsibility for their learning, plan, set goals, reflect, and action the need to change thinking. This term is applicable to research both in relation to how adaptive professionals *think* and how their pedagogies foster students' agency in the classroom. Self-regulation can be compared to Freire's (2005a, 2005b) construct of conscientisation in which an individual deeply understands their place in the world (Nevin & Cardelle-Elawar, 2003). If this notion is applied to my research, a teacher's conception of technology education can be determined through their espoused perception and manifesting practice, which can be mediated as a result of their past or present professional experiences (Diaz-Greenberg, Thousand, Cardelle-Elawar, & Nevin, 2000; Harding, London, & Safer, 2001).

Self-regulating teachers (and students) often present as motivated learners, who have high self-efficacy and intrinsic motivation. With appropriate support, self-regulated students are likely to find a learner-centred approach to technology education an experience that affirms their confidence, but this will depend on the professional skill of the secondary teacher to organise the learning process appropriately. Although adolescents are undoubtedly capable of innovative thought, they are less likely than their younger counterparts to volunteer or articulate their ideas unless the teacher fosters a classroom environment where they feel safe to engage and take risks in their learning (Bandura, 1982; Covington & Omelick, 1984; Schunk, 1985). Inevitably, there are some students (and teachers) who engage with learning and intuitively work autonomously and without the need for systemic intervention.

Student engagement is a concept that has historically focused on teachers' need to increase achievement, encourage positive behaviour, and a sense of belonging within the classroom (Parsons & Taylor, 2011). Whilst important concepts, there has also been a focus in New Zealand on developing students' lifelong learning

capabilities to support their ability to function in a knowledge-based society (Gilbert, 2007). Student engagement has evolved as a means to cater to students who may be “at risk” of underachieving or disengaging from school altogether (Finn & Zimmer, 2012). In technology education, this might equate to placing students in programmes that support pathways in the Trades or to learning can be facilitated through authentic contexts.

Authentic learning contexts can be used to support understanding about real-world issues or to identify needs or opportunities within local or global communities (Berwald, 1987; Lombardi, 2007; Peacock, 1997; Snape & Fox-Turnbull, 2013). By engaging students in authentic learning, teachers can provide opportunities to consider knowledge from a range of disciplines and others’ perspectives and consequently, learning from the *Nature of Technology* strand can be addressed. Learning of this nature can provide opportunities for sustained problem solving and decision-making, exposure to a range of theoretical concepts, and collaborative working methods (Lombardi, 2007). Whether students are provided with this opportunity however, is likely to be determined by what teachers’ value in their classroom.

2.4 Teacher perceptions and valued knowledge

A teacher’s view of the official curriculum and their pedagogical philosophies encompass personally held values and beliefs about the role of education and the purpose of the subject they teach (Alsup, 2006). Research into teachers’ perceptions can focus on values, beliefs and the effect of lived experience on practice (Bell & Reinsfield, 2012; Chikasanda, Otrell-Cass, & Jones, 2011). Some literature reviewed considers practitioner understandings of the concepts presented within a curriculum and on emerging practices in the classroom (Bungum, 2006; Cowie, Moreland, Jones, & Otrell-Cass, 2008; Jones & Compton, 1998; Jones & Moreland, 2003; Mittell & Penny, 1997; Moreland, Jones, & Northover, 2001). For example, the Learning in Technology Education Project (LITE) considered how teachers’ perceptions influenced the technological capability of primary school students through their exploration of teachers’ practices (Jones & Carr, 1992). The research explored schools’ “subcultures” and how they represented the perceived nature of technology education, the role of the teacher, its impact on teaching practice and expectations around student learning.

This research focused on the enactment of the previous New Zealand curriculum (MoE, 1995).

Other research explored how teacher perceptions influenced the effectiveness of professional learning as a means to enable pedagogical change (Aminudin, 2012; Johnson, 2011). Jones' (1997) work drew upon Pajares' (1992) conception of perceptions, defined as

Attitudes, values, judgments, axioms, opinions, ideology, ...conceptions, conceptual systems, preconceptions, dispositions, implicit theories, explicit theories, personal theories, internal mental processes, action strategies, rules of practice, practical principles, perspectives, repertoires of understanding, and social strategy. (p. 4)

Perceptions can also be interpreted through linguistic meaning, concepts, or theories, and through a physical or conceptual lens (Määttänen, 2015). Määttänen argued that because the mind cannot be separated from the body, it provides a viewpoint to the world. In other words, a teacher's body language could indicate how they are feeling about an activity, such as their engagement in professional learning or teaching of curriculum concepts.

2.4.1.1 How teachers' perceptions manifest in practice

Teachers' perceptions can be aligned with the way that they interpret a curriculum or engage with professional learning and how this is manifested in their practice, as outlined in Table 5.

Table 5. Teachers' perceptions and professional practice

Perspective	Rationale	Practice
Teaching as a craft (Grimmett & MacKinnon, 1992; van Driel, Douwe, & Beijaard, 2000; Zeichner, 1986)	<i>An apprenticeship</i> model, focused on the accumulation of teacher capacities	Developed through trial and error.
Competency or standards based (Frank et al., 2010; Leung, 2002; Zeichner, 1986)	<i>Mastery</i> of knowledge and teaching skills to meet the mandated professional standard	Focuses on the competencies required to perform their job.
To nurture understandings (Hargreaves & Fullan, 2012; Sprinthall, Reiman, & Thies-Sprinthall, 1996; Zeichner, 1986)	<i>Consolidating</i> practice in response to the educational agenda	Less focus on personal teaching skills and more on pedagogical models to support student learning.
Inquiry based (Darling-Hammond & Richardson, 2009; Hollins, McIntyre, De Bose, Hollins, & Towner, 2004; Zeichner, 1986)	<i>Reflexive</i>	Examines political, moral and social affects on practice.
To acquire/share knowledge (Graham et al., 2006; Tanner & Tanner, 1990)	<i>Transmissive</i>	A focus on knowledge acquisition rather than creation.
Progressive (Tanner & Tanner, 1990; Sharp, Green, & Lewis, 2017)	<i>Knowledge creation</i> - The perspective that education is transformative in nature	An emphasis on experiential, problem solving approaches, critical thinking, group work, development of social skills, social responsibility, and lifelong learning.

Table 5 identifies some perceptions of professional learning likely to influence practitioners' openness to reflect upon or change their thinking and practice. For example, a competency based expert is likely to focus on the mastery of teaching of skills and knowledge, knows what is required of them professionally, can identify goals that will assist in their development, and is likely to view professional learning as a means to realise these aims. The differing attitudes are presented here as likely to enable, moderate or limit teachers' manifesting practice. The social, cultural, political, and economic discourse is also likely to influence what is emphasised or considered to be legitimate knowledge in a country or school setting (Williamson, 2013).

In such a context, there are inevitable barriers to the teaching of the technology curriculum, particularly if teachers' nurture a traditional view of the subject's purpose. Traditional approaches to learning value replicability, reliability, communication and control, which are concepts that are disparate to the constructivist philosophy defining the current technology curriculum (Heinich, 1984; MoE, 2007). Constructivist approaches to learning value collaboration, individual autonomy, active engagement, personal relevance and pluralism, and are a means to acknowledge students' interests, to allow them to make sense of their learning, and be active creators of their own knowledge (Archambault, 1974; Cook-Sather, 2002; Duckworth, 1996; Lebow, 1993). It is likely that if a teacher's ideology prioritises the technicist benefits of technology education, they are likely to find engaging with the current curriculum conceptually challenging.

2.4.2 Teacher ideologies

Schiro's (2008) ideologies asserted that technology teachers are likely to align with four main perspectives including the scholar academic, social efficiency, learner centred, and social constructionist. These ideologies have been adapted to align with my research focus.

1. Scholar academic (Knowledge-driven) - A technology teacher may be situated in a school where academic outcomes are highly valued
2. Social efficiency (Socially-driven) - A technology teacher believes that the purpose of the subject is to prepare students to be functioning members of society and consider vocational education as a means to realise this
3. Learner centred - A technology teacher focuses on the needs of the individual, basing the learning on students' holistic well-being and interests
4. Social reconstructionist (Philosophically-driven) - A technology teacher views the purpose of education as a means with which to facilitate the construction of a more just or equal society (Reinsfield & Williams, 2015).

It is acknowledged here that a technology teacher is likely to align with more than one ideological view. Further, a school community may advocate for one ideological view of technology education, which may be disparate to a teacher's understanding of their subject. Inevitably, others' expectations are likely to affect

a teacher's pedagogical practice within their school context (Reinsfield & Williams, 2015). For example, Williams (2012) asserted

While the nature of technology education developed within a country must be designed to serve the country's needs, and build upon the unique history of technical education resulting in a relevant technology education program, what happens in the technology classroom is dependent on the teacher's beliefs about technology in the broadest socially orientated context. (p. 12)

By interpreting teachers' perceptions of the purpose of technology education, there is an opportunity to gain understanding of how teachers' negotiate the continuing tensions that affect the subject. In some socio-cultural settings for example, valued knowledge is tacit (difficult to communicate by writing it down or discussing it) and embedded within a school's history.

Some knowledge persists despite its potential irrelevance to the curriculum concepts. An example in food technology is teaching students how to wash the dishes. This is one of the first concepts that a Year Nine class can be taught about in this technological area. How to wash dishes can be presented as valued knowledge because it is perceived to be a parental expectation and assists teachers in maintaining their codes of practice (in this case food safety). Teaching about the rules and routines of a technology classroom, and in particular, safety issues, exemplifies the hidden curriculum within technology education. There needs to be further understanding around how tacit knowledge and beliefs have a reciprocal relationship for teachers, and how the value of both become embedded within their professional practice (Reinsfield, 2016b). From a socio-cultural perspective, teachers' expertise develops over time in a particular social context, through the acquisition of knowledge and engagement in discourse, norms, and the practices of a particular community (Fuhrer, 1993; Lave, 1997; Lave & Wenger, 1991). Teachers' ways of thinking are likely to connect to their lived experiences but will also be mediated by the socio-cultural context.

2.4.3 Ways of thinking and knowledge for practice

By identifying representations of the current discourse in technology education, teachers' thinking processes can be established. Meyer and Land (2003) argued that teachers "perceive, apprehend, or experience particular phenomena [which] might lead to a privileged or dominant view and therefore a contestable way of

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understanding something” (p. 1). Such a perspective is of interest here because there are “core concepts” presented within the technology curriculum, communicated as Achievement Objectives and within the Indicators of Progression documentation (MoE, 2007, 2010). The curriculum documentation provides a means for teachers to plan and structure students’ evolving understanding in the subject. To make meaning of and then enact these concepts, teachers will inevitably draw upon existing knowledge or seek to establish new understandings. To do so, they are likely to engage with ritual, inert, conceptually difficult, or alien knowledge (Meyer & Land, 2003; Perkins, 1999).

Ritual knowledge is described as being routine and systematic in nature (Perkins, 1999). Within technology education, this might be represented by a teacher who views the subject as being technical in nature and expects students to reproduce existing products, by focusing on a manufacturing process and the development of quality outcomes. Inert knowledge can include information that can be retrieved as required but not used actively (Perkins, 1999). For example, experienced teachers are likely to use established and specialised content knowledge, and in technology education, this may be associated with the function or properties of materials.

The pertinence of some knowledge may become troublesome, if teachers have difficulty making connections with the technological concepts, as they are presented in the curriculum (MoE, 2007). This could be because practitioners find some information conceptually difficult, thus causing a retreat to ritual knowledge, with a rationale that it addresses their students’ learning needs (Meyer & Land, 2003; Paechter, 1995; Perkins, 1999). For some teachers, the knowledge being presented in the curriculum is alien to them, or they might not even recognise that the concepts presented are contrary to the way that they perceive the subject. This may be because the knowledge conflicts with their beliefs, or because of its perceived conceptual focus, which they do not value. This research explored how teachers valued knowledge in technology education, as represented through their engagement with the curriculum or emerging practice, self-concept and professional identities (MacGregor, 2017; Giddens, 1984).

2.4.4 Self-concept and professional identity

Self-concept is a notion that considers an individual's belief or conviction, especially when they are provided with a choice (Zlatković et al., 2012). It is multi-faceted and hierarchical and can be investigated by studying perceived self-esteem or the dynamics of a teacher's relationships with others (Brookhart & Freeman, 1992; Baumeister, 1999; Kadi-Hanifa & Keenan, 2016). A teacher's self-concept and the way that they describe their practice can be explored through Hoyle's (2008) view "that one of the defining characteristics of members of a profession is the ability to function effectively in uncertain and indeterminate situations" (p. 285). Self-concept is pertinent to this research because teachers' understanding of the nature of technology education is perceived to have a direct correlation with their emerging professional practices (Biggs, 2006; Dakers, 2006; de Vries, 2005; Fox-Turnbull & Sullivan, 2013).

Anecdotally, my own experience of working with practitioners indicates that a professional's practice needs to be viewed holistically rather than separated into distinct categories; each individual will have strengths and areas for development. For example, if an experienced teacher states that they plan "intuitively", this might indicate a resistance to change, a lack of reflection or a dependence on the previous strategies (and knowledge) they perceive to be effective. Whilst the resulting teaching might be received well by some students there could also be alternative approaches that would better accommodate learners' needs.

A person's self-concept evolves as the result of the school context within which they teach and their sense of professional belonging (Guskey, 1988; MacGregor, 2017; Roche & Marsh, 2000; Shavelson, et al., 1976). Within this research, teachers' conceptions of self are perceived as their "abilities, interests, needs, values, past history and aspirations" (Gibson, 2003, p. 593). Of interest here, is how their self-concept aligns with their notion of "Possible selves", which considers where individuals see their future, and what they would like to become or are afraid of becoming (Cross & Markus, 1991). Teachers' engagement with professional learning can mediate this process.

2.5 Professional development

To fulfil their professional responsibilities, teachers in New Zealand are expected to engage in continuing professional development and maintain currency within their educational context (New Zealand Education Council (NZEC), 2016). Despite its importance in developing teachers' understandings, many professional development opportunities can be fragmented, detached from the curriculum and are disconnected to teachers' learning needs (Borko, 2004; Cohen & Hill, 2001; McDiarmid & Corcoran, 2000). Eraut (1994) proposed three contexts in which professional knowledge can be developed. The first is in an academic context (such as University study), the second as the result of workplace discussion based on policy or practice and finally, as the result of teaching practice itself. All of these concepts assume that teachers are motivated to change or engage with thinking that will develop their professional practice.

In New Zealand, teachers are expected to be lifelong learners - committed to developing their understanding of contemporary pedagogy (MoE, 2007). The factors to enable teachers' evolving professional knowledge can include a collaborative community, which focuses on continuous improvement, internal and external partnerships, effective leadership, time to reflect and critically analyse one's own practice, sound knowledge of pedagogical practice for application in differing learning contexts, and a safe environment to take risks (Fullan, 2002; Glaser, 1984; Hargreaves, 2000; Hargreaves & Fink, 2004; Harris, 2002; Koehler & Mishra, 2009; Le Fevre, 2014; Louis, Marks, & Kruse, 1996; Putnam & Borko, 2000; Shulman, 1986, 1987; Timperley & Philips, 2003).

When engaging in externally provided professional learning, teachers can be provided with information, which they then need to make sense of, for their own school setting (Gravani, 2007; Hawley & Valli, 1999; Murrell, 2001). In a climate where teacher learning is expected to be continuous process, an inquiry-based or collaborative approach to professional development can be a means to recognise existing experiences and understanding, to situate the process as being social in nature and directly connected to practice (Garet et al, 2001; Webster-Wright, 2017).

The influence of technology on professional learning also needs to be considered. The principles of connectivism can be used to support teachers to think differently about their learning, or to foster new understandings through the use of technology (Siemens, 2014). Online platforms (like Moodle) for example, can provide discursive learning contexts, to accommodate the sharing of diverse views from colleagues outside of teachers' immediate school community, thus extending the scope of their evolving understandings (Kear, 2011; Lai, Khaddage, & Knezek, 2013). Access to a combination of these learning contexts would appear most appropriate to support teachers' sustained professional learning. The government advocated for models in the New Zealand context are discussed next.

2.5.1 Professional development models in New Zealand schools

There is the risk that the professional learning structures in schools could limit teachers' engagement with professional learning. For example, within New Zealand schools, there are currently three performance appraisal approaches being advocated by the New Zealand Education Council [NZEC] (2016), including learning conversations, goal setting and teacher inquiry. These systems support awareness of and adherence to the professional standards (NZEC, 2017), which outline quality teaching in Aotearoa New Zealand. Appraisal processes in New Zealand are closely linked with student outcomes and are supported with the provision of best practice models to guide schools' monitoring processes (Education Review Office [ERO] 2012; Timperley, Parr, & Betanees, 2009). There is a tension caused by these models in terms of the accountability of teachers and their need to participate in pedagogical risk-taking. Timperley and Alton-Lee (2008) indicated however, that

The most powerful professional development for teachers involves them in an inquiry and knowledge cycle that starts with the identification of students' needs, moves to develop the knowledge and skills teachers require to meet those needs, and then checks to find out if changes in teaching practice have achieved the desired results. (p. 10)

A teaching as inquiry model is presented in the New Zealand curriculum (MoE, 2007, p. 35), communicating an expectation that teachers should be adaptive in their approaches and have the motivation and capacity to be responsive to their students' needs. Adaptive teachers are able to manage the complexities that influence their practice (Soslau, 2012); they are reflective practitioners who

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choose pedagogies in a deliberate and informed way to improve their students' future learning outcomes (Lampert, 2010; Liston & Zeichner, 1990).

In New Zealand, educators are increasingly encouraged to utilise inquiry-based professional learning approaches to navigate the contextual challenges within their school. Inquiry is also mentioned in the professional standards (NZEC, 2017), which indicates an expectation that it should be inherent to teachers' professional practice. Such an emphasis also assumes however, that teachers are generally well positioned to determine their own professional learning needs or that there is collegial support available to assist them in doing so. It does not acknowledge those teachers who are unable to articulate or determine how their practice should be responsive to changes in the curriculum or the needs of their students.

School-based approaches to professional learning are increasingly using the teaching as inquiry approach to enable and sustain contextual change through the development of communities of practice (Wenger, 1998). The notion of communities of practice is often associated with the promotion of innovation and the co-construction of knowledge through a process of social learning (Lave & Wenger, 1998). Lave and Wegner (1991) situate learning as a means to increase participation within a community of practice and in New Zealand, a Community of Learning (CoL) model has been introduced by the Ministry of Education (MoE, 2016c) as a means for schools to work collaboratively, share expertise, and improve students' learning outcomes. For teachers to engage with this approach to professional learning is likely to require them negotiate the meaning of their current understandings in their school context (Friedrichsen, Munford, & Orgill, 2012; Lave, 2009; Lave & Wenger, 1991; Wenger, 1998). Theories about situated practice can however, lead to a tension for research focusing on everyday, individual actions and the more difficult task of conceptualising the relationships and meaning between peoples' actions and their social context (Edwards, 2005; Lave, 2009).

There is a paucity of literature, which describes how technology teachers engage with or take responsibility for their own professional learning in their own school context or for their emerging practice. In the technology education community in New Zealand, there has been a tendency for passive professional development

models where teachers rely on others to inform them of how their pedagogy should manifest (Granshaw, 2010).

In technology education, to be adaptive practitioners, teachers are required to gauge students' conceptual and real-world understandings and provide learning opportunities that facilitate deeper learning (Allen, Webb, & Matthews, 2016). A teacher needs to be responsive in both their planning and teaching, and the development of supporting resources should reflect curriculum concepts (Allen, et al., 2013). In this context, there is a need for technology teachers to have sound pedagogical knowledge and a commitment to a constructivist approach to teaching (Goodwin & Webb, 2014; Saxton et al., 2014). Learning may take the form of problem based learning (PBL), inquiry learning, and experiential learning and lead to an environment where there is less intrusive teacher guidance (Barrows & Tamblyn, 1980; Berwald, 1987; Boud, Keogh, & Walker, 1985; Kirschner, Sweller, & Clark, 2006; Kolb & Fry, 1975; Lombardi, 2007; Papert, 1980; Peacock, 1997; Rutherford, 1964; Snape & Fox-Turnbull, 2013). Teachers can provide opportunities for students to construct their own knowledge, as the result of their experiences (Kirschner, 1992). The same approaches can be applied to teachers' meaning making processes, alongside external professional development models.

2.5.1.1 External professional development models

In the New Zealand secondary school context, there are standardised programmes available for teachers, which focus on the delivery of content. An example of this would be the NCEA Best Practice Workshops, which are trainer centred and disseminate information to teachers about the assessment requirements for national qualifications (NZQA, 2017). Whilst the necessity for teachers to receive information about assessment is acknowledged, there is a risk with this type of model that a teacher attends external professional development and is exposed to alien knowledge that they then have to attempt to translate into their own school context. This can be problematic - particularly if teachers are working in isolation as the only teacher for their area of technology.

For technology teachers, there are also additional external professional learning opportunities, as offered by Technology Education New Zealand (TENZ) (2016).

TENZ is a professional network, designed to promote and foster the development of technology education in New Zealand. TENZ has previously offered a professional learning programme to promote best practice in technology education, to examine the theoretical understandings that underpin the subject, with a view to makes connection between a teacher's knowledge and classroom practice (TENZ, 2016). This programme was likely to be most beneficial for adaptive teachers who could independently mediate the learning process and transfer knowledge and for application in their existing practice.

The literature suggests a continuing need for technology teachers to develop their understandings in order to reflect upon the nature of technology education (Jones, 2009; Williams, 2012; Williams, & Lockley, 2012). There is support in the New Zealand education system, for a collaborative approach to professional learning, which assists the evolution of teacher understandings (Ferguson, 2010; Jones, 2003; Jones, et al., 2013). However, the supervision of curriculum in secondary schools, rather than being collaborative in nature tends to fall to department leaders. In technology education, responsibility is often relinquished to a curriculum leader who is expected to model effective pedagogical practice, manage historically placed and context specific expectations, whilst also continuing to support colleagues' evolving practices (Jones & Moreland, 2003).

2.5.1.2 School-based professional learning

The drivers for school-based professional learning can be systemic or personal, and their effectiveness can be determined by teachers' motivation to engage, sustain, or change their educational practice (Grundy & Robison, 2004). According to Grundy and Robinson, there are three main drivers for professional development, which include extension, renewal, and growth. Extension encompasses the introduction of new knowledge and skills; there is the potential for innovation, and opportunities for teachers to extend their traditional practices to reflect, change, and embrace new pedagogies (Grundy, 1987). The concept of renewal can be associated with a need for teachers to remain current in their practice. For example, there is a risk that for teachers who qualified more than 10 years ago that there might be a depth of pedagogical experience, but a deficit in their contemporary knowledge (Grundy & Robison, 2004). In such circumstances, teachers might not be aware of a need to change, or there may have been failed

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attempts at change, making them hesitant to try new approaches (Greenberg & Baron, 2000). Consequently, unless teachers are motivated or convinced to review their practice, they are likely to retain the status quo; they remain secure relying on habitual practice, fearing the unknown consequences of changed actions (Boyatzis, McKee, & Goleman, 2002; Fullan, 2002). Teacher growth is conceptualised as being observed over the duration of a professional's career - likened here to the notion of lifelong learning.

According to Timperley and Alton-Lee (2008), professional learning is a more appropriate term than professional development because teachers need to position themselves as learners to apply newly acquired knowledge and with a motivation to enable personal change. Stoll, et al., (2012) argued that there are various factors to influence effective professional learning. These include having an end goal in mind, accepting that challenging peoples' thinking is part of the process of change, and acknowledging the school and individual's needs. To enable such a vision, it is important that both situated and external expertise is utilised, and diverse professional learning opportunities are sustainable. Inquiry-based models, collaborative learning practices within and between schools, and effective leadership can all foster a supportive learning environment for teachers.

Of interest in this research is whether there are barriers or enablers to professional learning for technology teachers. In particular, whether school-based approaches accommodated teachers' individual learning needs, or fostered a learning community where there was a shared commitment to work collaboratively and manage a process of risk-taking and curriculum change (Day & Sachs, 2004; Sachs, 2000). There are often time constraints in a school context, which influence the nature of professional learning, and cause Heads of Department (or Faculty) to adopt a leadership role in curriculum related activities. In this situation, power relationships can emerge as a result of the knowledge that is presented as being legitimate (Apple, 2013).

Kincheloe (2012) stated that only by "engaging in complex, critical research will teachers rediscover their professional status, empower their practice in the classroom and improve the quality of education for their pupils" (p. i). Such an environment might encourage teachers to make meaning of the curriculum in an emancipatory manner, and acknowledge the differing teacher characteristics or

espoused theories of practice in technology education. Espoused theories of practice consist of teachers' worldviews and the values and beliefs that drive their teaching (Anderson, 1994). Approaches to professional learning should be inclusive of the diverse professional identities represented in the technology education teaching community - as long as the emerging understandings encompass the intent of the curriculum (MoE, 2007).

Professional identities are formed as the result of activity and participation in daily interactions, the nature of which can be defined by relationships of power, polite submission, entitlement, social roles, and pre-determined organisational structures (Holland, et al., 1998). To enable change in technology education, professional learning opportunities need to consider these tensions and encourage meaningful reflection and conversation about teachers' evolving professional practices in their particular school context (Fullan & Hargreaves, 1996).

There is limited information about the ways in which teacher dialogue can facilitate a change in practice but of interest here is what technology teachers talk about during professional discussions, how they position the curriculum, and whether conversations are likely to influence the interpretation and enactment of concepts within the official curriculum (Deglau, Ward, O'Sullivan, & Bush, 2006).

2.6 Chapter summary

This chapter outlined the context within which this research is situated. The technical origins of the subject, government policy, school communities and teachers' perceptions all contribute to persisting tensions that are likely to influence understanding and enactment of technology education in the secondary school context. The literature suggests that our existing curriculum has developed in response to international trends rather than to suit the needs of its users, whose understandings appear to be mediated by their own experiences and school context. Chapter three explains how this research project was conceptualised and explores how cultural, historical, institutional and individual factors can influence a teacher's subjective understanding and professional practice.

CHAPTER THREE: CONCEPTUAL FRAMEWORK

3.1 Introduction

This chapter presents the conceptual framework that underpins this research and consists of two main sections. The first focuses on theoretical perspectives, which include the interpretivist paradigm, a socio-cultural lens, and activity theory. The second section describes how the research context (as outlined in Chapter two) is inclusive of teachers' self-reported perceptions, as represented where practitioners interpreted or described their enactment of the technology curriculum. The ways teachers made meaning of the curriculum to develop knowledge for practice are discussed (Wertsch, del Río, & Alvarez, 1995).

By situating the research within an interpretive paradigm, teachers' differing worldviews and experiences can be acknowledged and considered in relation to their manifesting practices. A sociocultural lens is also discussed to signal the potential relationships or contradictions in cultural, historical, institutional, and individual factors that can influence a teacher's professional practice. Activity theory is presented as a means to consider how individual, social and organisational factors can be influenced or influence the ways that professional learning is mediated through the use of tools (Ellis, Edwards, & Smagorinsky, 2010; Kaptelinin & Nardi, 2006; Zinchenko, 1995). Finally, threshold concepts and the notion of liminality are introduced to contextualise teachers' knowledge and meaning making for practice.

3.2 An interpretive paradigm

Research paradigms can be classified to include differing worldviews and lenses through which to conceive the construction of knowledge (Donmoyer, 2006; Gephart, 2004; Krauss, 2005; Lather, 1986; Lincoln, Lynham, & Guba, 2011; Ponterotto, 2005). Kuhn's (1962) view was that a paradigm could define a set of beliefs, values, and assumptions about research, implying a pattern or structure to inquiry, which can be supported with academic ideas and assumptions (Olsen, Lodwick, & Dunlap, 1992).

For the purposes of this research, an interpretivist framework was used to acknowledge that reality has multiple perspectives, is socially constructed and holistic in nature. Interpretivists believe that there is no single answer or correct

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view of knowledge and so this aligned with the aim of the research - to explore how each teacher's perceptions influenced their practice (Willis, 1995). The focus of this research was to "get inside the person and to understand from within" (Cohen, Manion, & Morrison, 2011, p. 17). My study was designed to be responsive to my field of interest - the circumstances of secondary technology teachers in education. It deliberately aimed to facilitate nuanced exploration, probing, and understanding of phenomena, and was the most sensitive approach for my research problem (Heidegger, 1954, 1977, 1996). Heidegger's view was that *being* could be studied from an ontological perspective to determine the affect of time on a phenomenon. His perspective considered technology to be potentially detrimental to man because of its potential to hinder an individual's evolving self-knowledge, leading to a particular way of thinking; by questioning the nature of technology, humans can come to understand themselves and use their values to shape both the world and their own lives (Heidegger, 1954). In this research, the actions of the participant teachers were considered to be intentional, have meaning and be future-orientated in nature (Cohen, et al., 2011).

An interpretivist framework accommodates the analysis of a phenomenon within a particular context to allow a researcher to work closely in the field (Cohen, et al., 2011; Reeves & Hedberg, 2003). It does not assume a value-neutral position but relies on the grounded nature of the data generated as a result of the research focus (Orlikowski & Baroudi, 1991). Specifically, I used grounded theory to discover the ways that individual teacher's perceived their schools' discourse and collegial dynamics were affecting their practice (Charmaz, 2006; Glaser, 1992).

I have worked in the technology education community for over 20 years (in England and New Zealand) at national, tertiary, and secondary school levels. Accordingly, this research was positioned to acknowledge my own perceptions and insight into the discourses within technology education. Such an approach was described by Glaser (1992) as theoretical sensitivity, and the intent was to acknowledge my "knowledge, understanding, and skills" (p. 27). My previous immersion in technology education was viewed as a strength and I felt sufficiently detached from the secondary school context to be reflexive about the research data. I was still viewed and accepted by the participants as a technology teacher, which lead to the development of trusting relationships and shared understanding

of their circumstances - I was an outside, insider (Glaser & Strauss, 1967, p. 226). In this research there was interest in whether the socio-cultural context in two different schools impacted significantly upon teachers' practice.

3.3 A sociocultural lens

Sociocultural theory underpins this research study, to explain how teachers' perceptions influence the ways in which they make meaning of the technology curriculum (MoE, 2007) in their cultural, institutional, and historical contexts (Wertsch, et al., 1995). By adopting a sociocultural lens, there was an emphasis on technology teachers' practice, as influenced by the cultural contexts of both their school and subject community. From this perspective, I could determine what teachers needed to know to teach, in their sociocultural context (Bell, 2010).

According to Pajares (1992), theorists are in general agreement that enculturation and social construction can sometimes mean that individuals' perceptions differ from reality. This is pertinent to this research, which investigated the disparity between individuals' perceptions, their actions and the wider organisational structures of a school (John-Steiner & Mahn, 1996). Concepts from Vygotsky's (1978) work are used to explore the social implications of individual development, as transformed, negotiated, and represented through participation in a sociocultural activity (Hayes & Mutasov, 2005). For example, Vygotsky asserted that word meaning might be viewed "not only as a unit of thinking and speech but as a unit of generalisation and social interaction, a unity of thinking and communication" (1978, p. 49). Human actions are represented here as being purposive and culturally meaningful in nature, rather than biological or reactionary (Kozulin, 1986). In a professional school setting for example, there is an expectation that teachers behave in a socially appropriate and constructed manner. The notion of semiotic mediation is presented here to posit that all thinking facilitates some form of sign, to manifest as a form of consciousness (Wells, 2007). All human activity is shaped by an interaction with a variety of tools, which can inhibit, moderate or enable subsequent actions (Bakhurst, 2009). For example, from Voloshinov's perspective,

The reality of the inner psyche is the same reality as that of the sign... By its very existential nature, the subjective psyche is to be localized somewhere between the organism and the outside world, on the borderline separating these two spheres of reality. It is here that an

encounter between the organism and the outside world takes place, but the encounter is not a physical one; the organism and the outside world meet here in the sign. Psychic experience is the semiotic expression of the contact between the organism and the outside environment. (1973, p. 26)

Socio-cultural development however is more than just the result of biological features; it is also concerned with how society and its culture manifest as a result of historical events (Claiborne & Drewery, 2010). The emphasis here is how teachers' interpretation and enactment of the curriculum is influenced by others' perceptions of the nature of technology education in their school and within the community.

The study of social behaviour is made challenging because of the ambiguity caused by its very nature (Cohen, et al., 2011). Cohen, et al. state that the importance of action and its meaning is now generally recognised in social research, and one of the benefits of a sociocultural approach is that it can represent individuals' versions of truth to provide deeper insight into their actions in particular circumstances. To facilitate such knowledge, this research drew upon cultural-historical activity theory.

3.3.1 Cultural-historical activity theory

Cultural-historical activity theory is suited to research where there is interest in the mediation of human activity through physical or psychological tools to allow for a "shift in emphasis from individual to collective subjects" (Ellis, et al., 2010, p. 3). This focus was necessary because I was interested in how individuals' perceptions were mediated within group situations (like department meetings) or translated into the classroom context.

A cultural-historical perspective "offers a powerful theoretical and methodological lens" (Ellis, et al., 2010, p. 2), where issues of teacher education, curriculum and programme design can be considered. Through such a lens, my research considered whether the subject's technical roots were continuing to influence teachers' perceptions. It focused on the activities and tools used to develop shared understanding in a school or department culture to generate new knowledge and provide insight about how these factors enabled, moderated or limited teachers' practice.

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Activity theory was an appropriate means to conceptualise internal operations within a school, the department settings, and to establish teachers' shared understandings within their own community of practice (Wenger, 1998) because

...Any local activity resorts to some historically formed mediating artifacts, cultural resources that are common to the society at large. ...In unique ways, they solve problems by using general cultural means created by previous generations. (Engeström, Miettinen, & Punamäki, 1999, p. 8)

This research interpreted individuals' interactions in social settings, with a view to represent the nature of technology education in those contexts. There was interest in the nature of different activities (such as lessons) to identify any potential opportunities for change in teachers' practice. The activity settings were bounded by the school context, the curriculum focus, and teachers' perceptions and contextual data was assessed as being relevant and essential, as it emerged from the interpretive process (Tharp & Gallimore, 1998; Yamagata-Lynch, 2010). By identifying emergent features, the changing nature of each social context, in relation to teachers' understandings could be identified (Wertsch, et al., 1995). The next section describes the three distinct approaches to activity theory. Second and third generation activity theories were used for their descriptive nature and as an interpretive framework in this qualitative research (Yamagata-Lynch, 2010).

3.3.1.1 Three generations of activity theory

Socio-cultural theorists have used Vygotsky's (1978) first generation of activity theory, which centred on the concept of mediation and was represented as a triangular model. Vygotsky's mediated triangle situated the subject as the participant/s of an activity, and the tool was the object perceived to influence the actions of the activity. The first generation was constrained by its focus upon the individual however and did not consider the social nature of activity, which led to the development of the second generation of activity theory (Engeström, 2001; Engeström, et al., 1999).

The second generation of activity theory was developed by Leont'ev (1981) and intended to be inclusive of collective responses to human activity. Leont'ev's model identified three hierarchical levels of activity, including operations, actions and activity (Barab, Evans, & Baek, 2004). Here, there was an emphasis on the

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object of an activity, which was connected to the developmental goals and motives of the participants. In the context of this research for example, teachers' active engagement with professional learning (rather than passive acceptance of information) presented opportunities to develop shared or new understandings about the potential to transform practice. Advocates for second-generation activity theory assert that very little meaningful activity can be accomplished in isolation and that "the mind does not work alone" (Pea, 1993, p. 47). From this perspective individuals' knowledge and meaning result from collaboration with others in their community, as represented by joint actions (such as the teaching of technology), shared artefacts or the use of common language.

Cultural artefacts and the tools and knowledge required for their sustained use are passed through the generations (Barab, et al., 2004). Such a view is pertinent to this research because whilst teachers' of technology might use similar pedagogies, the physical artefacts used in their specialist areas can represent different meanings. During professional learning, knowledge can be challenged or reinforced by other technology teachers. There is a risk that teachers' motivation to change could be moderated if outdated perspectives are the dominant discourse. Further, individuals' understandings of the curriculum are likely to moderate their engagement in an activity, and the cultural boundaries in a school will impact on the ways that teachers are enabled to foster new or significant knowledge. There are features in the conceptual framework, which are drawn from Leont'ev's (1978) original model. These features are that activity is significant, social, and systematic, and participants make meaning as a result of their learning and engagement in a task.

For the purposes of this research, it is presumed that a teacher's perception of the role of technology education is the provocation for the way that they interpret and enact the official curriculum. However, a technology teacher's practice is socially embedded and likely to be reflective of explicitly stated rules, or alternatively, the practice within a school community. Assuming that activity is significant, social, and systemic, the way that a teacher's practice manifests is reflective of their sociocultural context.

According to Leont'ev (1981), operations sustain an activity, which is systematic and leads to conscious actions based on an individual's skills or knowledge. This

suggests that a teacher’s engagement in a professional learning activity (for example) is likely to be influenced by their prior knowledge or exposure to the curriculum as well as their motivation to develop further understanding. However, there can also be conflicting individual or collective actions, and motives can be disparate within a common goal. In the case of this research, second-generation activity theory was used to interpret each teacher’s lesson and the professional development meetings. The activity systems model is exemplified in Figure 2.

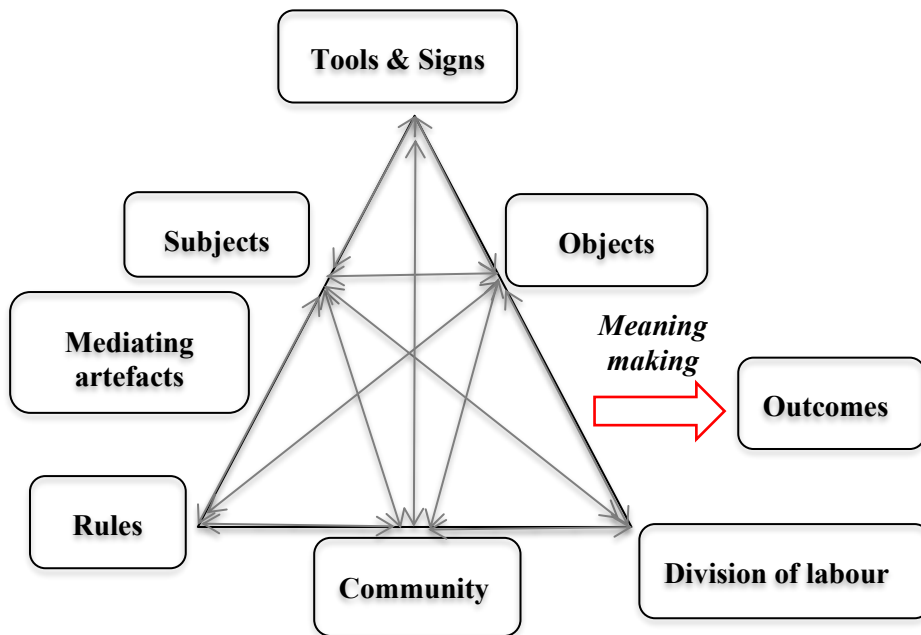


Figure 2. Engeström’s model of an activity system (2001)

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According to Engeström’s (2001) model, elements of an activity system are goal directed and consist of instruments, subjects, objects, rules, community, division of labour and outcomes. Their application in this research is outlined in Table 6.

Table 6. Activity theory as an interpretive framework

Activity system element	Explanation
Tools and signs	The theoretical ideas and resources available for teachers' developing understanding of technology education
Mediating artefacts	The conceptual and physical resources that represent teachers' learning processes
Subjects	Teachers of technology
Objects	Teachers' perceptions and engagement with the technology curriculum
Rules	The discourse determining the sociocultural environment
Community	Teachers of technology, school community and the influence of political agenda
Division of labour	Teachers' roles in the department, use of pedagogies
Outcomes	Representations of teachers' understanding of technology education.

The elements outlined in Table 6 are the mediators for an activity system, which can be used to understand human activity from a holistic perspective (Kuutii, 1996).

Third generation activity theory is useful to understand the intention of language use, acknowledge differing perceptions and the relationships between interacting activity systems that have a partially shared object - in this case, teachers' understanding of technology education (Engeström, 2001). According to Engeström, third generation activity theory

expand[s] the unit of analysis from a single activity system to multiple, minimally two, interacting activity systems. In such a framework, for example schooling is analysed as dynamics within and interplay between the activity systems of the student and the teacher, possibly also including other relevant activity systems. This expansion is accompanied with increased attention to the dynamics of the subject, with new important openings into the analysis of agency, experiencing, and emotion. (p. 2)

The model for this generation of activity theory is outlined in Figure 3.

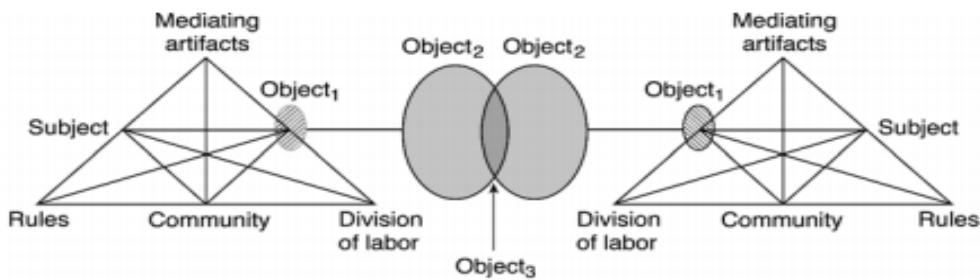


Figure 3. Engeström's (2001) proposal for a third activity system

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In Figure 3, Object 1 represents understanding about the nature of technology education, which is given meaning through the construction of activity systems in each school. The activity systems offer insight into the relationships between teacher perceptions, their engagement with the curriculum and professional learning activity within each school context (Nardi, 1996). The information from each school (Object 2) interacts to enable Object 3. Object 3 represents the commonalities or differences that result from comparisons between the two schools. The principles to be considered in this research include object-orientated activity, historicity, internalisation and externalisation, multivoicedness, and contradictions (Engeström, 2001; Kaptelinin & Nardi, 1995; Zinchenko, 1995). These principles are discussed in turn and contextualised within this research focus.

Object orientated activity presumes that an activity system is a unit of analysis or a network of relations, mediated by artefacts or objects, and informed by the processes in which individuals or groups engage, as motivated by their personal or collective goals. For the purposes of this research, I examined the interactions between “participant, object, motivation, action, goals, [in the] socio-historical context” (Yamagata-Lynch, 2010, p. 21) and the consequences of activities in relation to teachers’ evolving perceptions and meaning making of the technology education curriculum.

The second principle is historicity, which asserts that activity systems evolve over a period of time, within their own context. To better understand a system, the history of the activity, its objects, and the ideas and tools need to be considered (Engeström, 2001). The resources made available to teachers, the perceptions of

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the teachers and the historical factors influencing activity are pertinent to the way that the technological concepts within the curriculum are interpreted and understood.

According to Vygotsky (1978), human learning is an “outside-in” process described as internalisation and externalisation, where knowledge could be transformed from a social context to an inner psychological conception. Internalisation can be conceived as being “related to reproduction of culture; externalisation as creation of new artefacts makes possible its transformation” (Engeström, et al., 1999, p. 10). In the case of school-based professional learning opportunities (during department meetings) the driver for an advocated practice can be governmental policy or a school’s consequent priorities rather than teachers’ evolving curriculum understandings (Akiba & Wilkinson, 2015; Darling-Hammond & Sykes, 1999; Fullan & Mascall, 2000; Hargreaves, 2000). There is a risk that when there are generic rather than personalised goals, assumptions can be made about a teacher’s professional skills and knowledge, or indeed the conceptual processes that aid the transfer of new knowledge, for application in their practice. In this case, there may be tension between the internalisation and externalisation processes, because of the prescriptive nature of a collective activity. In other words, the concepts with which teachers engage are likely to be determined by what they value. Key here is an interest in “how interpersonal activity, including tools/and or language, became transformed into intrapersonal, mediated thought” (Engeström, et al., 1999, p. 412) or how teachers’ professional practice impacts on their perceptions of technology education. For example, a focus on the relationship between a teacher’s collaborative and independent action and their derived meaning was important to explore whether practitioners’ constructed new knowledge as the result of group discussions during department meetings.

Language can be a tool of intellectual adaption within the context of teacher learning (Vygotsky, 1962). Vygotsky (1987) described three forms of language pertinent to this research. Firstly, there was the nature of social speech as a means of communication with others. Secondly, was how private speech could be represented during teachers’ engagement with professional learning - assuming that private speech connects thought with words, as internalised, self-regulating,

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thinking, *in action*. An example of language as a tool of intellectual adaption might be that a teacher has their own belief about the way that the technology curriculum should be enacted but they regulate their thoughts and language to communicate an alternative, more socially acceptable perspective during department meetings. Alternatively, a teacher might disagree with the social speech represented in a professional context and choose to ignore what is being asked. During this research I explored whether teachers' actions aligned with or were disparate to their espoused theories of technology education, with a view to represent the multiple perspectives, customs and motivators in technology education.

An activity system highlights multiple perspectives, customs, and motivators (Engeström, 2001). The principle of division of labour acknowledges that participants will have their own experiences that mediate their responses. Activity systems can aid the acknowledgement of particular rules and conventions, as determined by the discourse in the sociocultural setting. In the case of department meetings for example, the ways in which they are organised and managed are likely to have implications on whether teachers feel empowered to respond, engage or challenge the dominant discourse. By comparing networks of interacting activity systems, the multi-voiced nature of technology education was explored to develop multiple case studies and inform recommendations for change in the technology community.

The relationships within an activity system are multi-directional and the hierarchies of an activity system are like networks, influenced by other activities and changes in the environment, to cause an imbalance or contradiction. The notion of "contradictions" is a key principle in activity theory and can identify tensions in a phenomenon. Advocates for activity theory consider contradictions as ways to develop understanding, facilitate change, or to motivate new learning (Kuuti, 1996). Contradictions can occur as the result of socio-historical circumstances within or across activity systems and at different stages of an activity (Bonneau, 2013; Engeström & Sannino, 2011, Kuuti, 1996). Contradictions can result as a consequence of socio-economic constructs that attribute value - like tensions in conceptual or practical skill development within a curriculum (Engeström, 1987).

There are four levels of contradictions including primary, secondary, tertiary and quaternary (Engeström, 1987). Primary contradictions emerge within the elements of an activity system (such as the rules) and can be attributed here to the differing perceived purposes of technology education, and the tensions caused by political or economic agenda. Secondary contradictions occur between the elements (such as the rules and subject) and signal the factors directly affecting teachers' practice. Tertiary contradictions emerge when teachers' motivations or knowledge challenge the dominant discourse, and there is a need to navigate a tension in practice - such as teaching a concept of the curriculum with which they are unfamiliar. Finally, quaternary contradictions can emerge between the main and external activity systems and represent collective tensions in thinking or practice. Identifying contradictions can recognise existing challenges to practice and support conceptual change (Kang, Scharmann, Noh, & Koh, 2005; MoE, 2007; Roth, 2013; Singer & Voica, 2008). The next section considers the factors influencing teachers' meaning making practices when engaging with the official curriculum.

3.4 Meaning making

The way that a teacher makes meaning of a curriculum will be dependent upon their understanding of its driving philosophy, their perceptions, and the social factors influencing their practice. For example, if a teacher believes they are a conduit for the curriculum, rather than a consumer, they will endeavour to reproduce its concepts rather than interpret them (Remillard, 1999). Meaning-making during mediated action can be aligned with Galperin's concept of orienting activity (1969, 1989), which "...Explains mental activity as the ability that allows human beings to explore, examine and predict potential results of actions they were preparing to imitate" (Yamagata-Lynch, 2010, p. 20).

Culturally and socially mediated activity can be explained through both internal and mental processes and within a sociocultural learning context (Galperin, 1969, 1989). The way that teachers' interpret and make meaning of the curriculum during a variety of activities and contexts provided insight into the nature of technology education within its socio-historical context. There was consideration of whether meaning making processes were attributable to teachers' authentic beliefs or a replication of others' views because

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The meaning of a word represents such a close amalgam of thought and language that it is hard to tell whether it is a phenomenon of speech or a phenomenon of thought. A word without meaning is an empty sound... Word meaning is a phenomenon of thought only insofar as thought is embodied in speech, and of speech only insofar as speech is connected with thought and illuminated by it. (Vygotsky, 1987, p. 212)

In other words, language use can represent individuals' agenda or beliefs. The ways teachers' described the technology curriculum, in the dialogue that they used during department meetings, or when teaching in the classroom provided insight to their perceptions. Bostad, Brandist, Evensen, and Faber (2004) argued, "Meaning springs out of dialogue and belongs to dialogue, making dialogue a core aspect of all forms of culture" (p. 7). Meaning is associated with someone's interpretation and can be derived "equally by whose word it is and for whom it is meant. As word, it is precisely the product of the reciprocal relationship between speaker and listener, addresser and addressee" (Voloshinov, 1973, p. 86). Such an attitude was pertinent, to explore the relationships or opposing forces during teachers' interactions with colleagues and students. Opposing forces in meaning were deemed likely to either unite or destabilise teacher understandings, which in turn could lead to a consolidation of thought or alternatively, a resistance to conditioning (Mortimer & Scott, 2003). Teachers' dialogue (how they theorise their practice) and actions (how they practice) therefore, provided insight into the way that they made meaning of the curriculum in their socio-cultural setting.

The transition from curriculum concept to practice is complex in nature and a policy of any kind is not just a text or document but is also a process that combines values, activity, and context to construct discourses (Singh, Thomas & Harris, 2013). Discourses manifest in the ways that subjective ideas and truths are shaped and presented and teachers' interpretations were explored by observing how their practice represented the curriculum, how they decoded it and the ways in which they applied it in practice (Ball, 2008; Kaptelinin & Nardi, 2006). The collaborative recoding of policy (such as the curriculum) through collegial discussion, the use of existing resources and other professional support was an area of interest to consider whether the contexts and communities determined what was privileged or irrelevant knowledge, in turn regulating that interpretation (Ball, 2012). The notion of threshold concepts is discussed in the next section.

3.4.1 Threshold concepts and liminality

As well as illustrating how teachers' meaning-making processes were influenced by their context, this research identified tensions that, once understood, could further support teachers' engagement with the technology curriculum (Peter, et al., 2014). A threshold concept is a means of providing a new or transformed way of interpreting something, and can represent how people perceive a discipline (Meyer & Land, 2003, 2006). There are characteristics that define threshold concepts, which

Should be transformative, with the intent to change perceptions... should be difficult to unlearn and inherent to understanding within a particular phenomenon... should be bounded, and enable the critique of past understandings, to challenge individual's own thinking processes... can also enable educational change, through the development of a new conceptual space (Meyer & Land, 2005, pp. 373 - 374).

Alongside these characteristics is the notion of troublesome knowledge, defined by Perkins (1999) as "alien, counter-intuitive, ritualized, inert, tacit or even intellectually absurd at face value" (Land, Meyer & Smith, 2008, p. 2). Troublesome knowledge can limit or moderate professionals' learning and practice and as a result, provide a deeper understanding of the conceptual processes that enable teachers' interpretation and enactment of the technology curriculum (Meyer & Land, 2005). The concepts that teachers found troublesome can be explained through the notion of liminality.

Liminality aids the understanding of a transitional space within a teachers' evolving thinking and acknowledges that professional learning can incorporate a threshold where teachers might be unable or unprepared to achieve a transformed status (Meyer & Land, 2003). For example, teachers who are resistant to change can adopt a form of mimicry (Ellsworth, 1997) to give the impression that they are engaging with curriculum concepts or as a means of coping with the constraints upon their practice. There are modal distinctions to offer insight into the differing understandings within a threshold concept (Meyer, Land, & Davies, 2008). These variations include the stages of subliminal, pre-liminal, liminal, and post-liminal ways of knowing. According to Meyer, et al., (2008), a teacher's way of knowing (episteme) can be the crucial factor to determine whether there is epistemological or ontological progression.

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A subliminal variation is described here as being reliant on tacit knowledge, which might manifest as the absence of explicit knowledge about a concept. Such knowledge may have been formally and previously acquired and has become intuitive in nature. A teacher who adopts a technical approach to technology education, or replicates curriculum concepts in their classroom, without understanding of their role, might reflect subliminal understanding. Alternatively, pre-liminal variation is evidenced when a concept is presented and received. At this point a teacher may choose to engage, resist or withdraw from the concept. This level of understanding might manifest by a teacher who has been exposed to information in a department meeting (for example) and understands it. The teacher can then choose to re-enact the concept, do so in a tokenistic fashion or opt not to translate the concept into a focus for learning, in their classroom. Liminal variation is the stage when learners have chosen to engage with a concept and is represented by how they engage with and make meaning of it. This might be represented by a teacher who wants to focus on a particular technological concept, has developed a classroom task based upon its key features, and trials it with a group of students. Finally post-liminal representation is where a learner transitions to a new conceptual space and can apply their understandings to future concepts or a range of learning concepts, as a result of a change in thinking. This would apply to the teacher who trials the activity in their classroom, gains feedback from students and then reflects on the effectiveness of the learning activity. By exploring teachers' understanding of the curriculum, threshold concept theory was used to propose strategies and innovative approaches to pedagogy, to assist in the transformation of practice where there was a need to, "provoke something else into happening - something other than the return of the same" (Lather, 1998, p. 492) (Johnson, 2013; Johnson, Khoo, & Peter, 2017).

3.5 Chapter summary

This chapter described how teachers' perceptions and practice in technology education could be explored by viewing the research from a socio-cultural lens, and within the interpretive framework of activity theory. It considered the differing ways that teachers' perceptions and actions provide insight into their understanding of the technology curriculum at an individual, social and organisational level. Further, the concepts of meaning making and knowledge for

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practice were introduced, in relation to the ways that mediated activity can potentially enable, limit or moderate a teacher's practice. Finally, threshold concepts and the notion of liminality were presented as a means of understanding teachers' evolving knowledge, with a view to identifying strategies that can support their evolving practices and enable educational change.

CHAPTER FOUR: RESEARCH DESIGN, METHODOLOGY, AND ANALYSIS

4.1 Introduction

This chapter focuses on the methodology and research design used in this qualitative, interpretive study. It consists of three main sections. The first describes multiple case study methods used to contextualise the research and communicate the nature of technology education in the two secondary schools. The research questions are presented again and are followed by the reasoning used to support the use of observational, self-report, and visual data collection methods. Lesson and department observations, semi-structured interviews, and the use of teacher-generated resources are also discussed as pertinent to guide this research, which was to consider technology education at an individual, interpersonal, and organisational level.

The second section of this chapter focuses on the ethics and quality assurance considerations within this research and the concepts of dependability, credibility, and transferability are discussed. The strategies used to ensure participants' versions of reality are represented. The data analysis section describes Nvivo 11 and coding as a means to assure the trustworthiness in this research. The final section outlines how activity theory was used as an interpretive framework for analysis.

4.2 Research methodology and design

This research project explored the perceived disparity between teachers' understanding of the New Zealand technology curriculum (MoE, 2007) and focused on the practice of six secondary teachers, in two New Zealand schools. It investigated how these teachers' perceptions and practice were mediated by their school context. There was direct contact with participants in a naturalistic setting. This was to consider how social arrangements and rules affected teachers practice, in their professional context (Patton, 2001).

A qualitative approach was used. Qualitative research can be broadly defined as "any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification" (Corbin & Strauss, 1990, p. 17) in a naturally occurring manner through an iterative and reciprocal process (Patton,

2001; Teddlie & Tashakkori, 2009). This type of research is distinct from quantitative research where there is interest in antecedent events and causation, prediction, and the generalisation of findings. My research sought the extrapolation of similar situations, to aid understanding (Hoepfl, 1997). In this research context, there was a deliberate focus on individual perceptions to then enable the representation of key emerging issues as multiple case studies. These multiple case studies were bounded by the nature of technology education, as it is conceptualised within the New Zealand curriculum (Creswell, 2007; Duff, 2008; Merriam, 1998; MoE, 2007; Stake, 1995; Yin, 2009).

A qualitative approach was appropriate for this research because it could be used to interpret technology teachers' complex social settings, to determine their social arrangements, the department's function, and the implicit and explicit rules affecting professionals' practice. My experience in the technology education community contributed to the interpretation of the data collected, to enable comparison, identify contrasting information, and determine patterns (Miles, Huberman, & Saldaña, 2014). A qualitative approach has not been well used in research into technology education. For example, Zuga's (1994) review of 220 'technology' related studies reported only 16 that specifically used qualitative methods and indicated that the most important challenge for technology educators was to "use rigorous and appropriate research techniques" (Hoepfl, 1997, p. 61). Denzin, Lincoln, and Giardina (2006) argued that

...Interpretive qualitative research creates the power for positive, ethical, communitarian change, and the new practitioners entering this field deeply desire to use the power of the University to make such a change (p. 779).

As a new and emerging researcher in the University sector, I designed this research to identify factors that challenge teachers' practice, with a view to promote change, as necessary. The overarching question to be considered was

How do technology teachers' *perceptions* influence their interpretation and enactment of technology in the New Zealand curriculum (MoE, 2007)?

Two further sub-questions provided a framework for the research

- i. How do teachers *interpret* the concepts presented within the official technology curriculum (MoE, 2007)?

- ii. How do teachers *enact* the concepts presented within the official technology curriculum (MoE, 2007)?

An overview of the data collection process, with links to the research questions, are summarised below.

Table 7. Summary of the research process

	Research question	Data collection method
Phase one: Teacher perceptions	How do technology teachers' perceptions influence their enactment of the New Zealand curriculum?	An initial semi-structured interview of approximately 40 minutes Observation of department meetings
Phase two: Interpretation of the curriculum	How do teachers interpret the concepts presented within the official technology curriculum?	Observation of department meetings Teacher generated resources
Phase three: Enactment of the curriculum	How do teachers enact the concepts presented within the official technology curriculum?	Lesson observation of one class or block, for between 45 minutes and one hour
Phase four: Developing the multiple case studies		

Table 7 highlights that there were four phases to the research. The first three explored different aspects of the research questions. Data were collected from semi-structured interviews, lessons and department meeting observations, and teacher-generated resources. The final phase explored the nature of technology education, as represented by the case studies of two secondary schools. A case study approach is discussed in the next section.

4.2.1 A case study approach

A case study approach is suitable for one or several areas of interest to consider complex and contemporary issues from a variety of perspectives and to illustrate multiple realities. Case studies are suited to interpretative research and enable the representation of phenomenon (Duff, 2008). The case study method provided a means to represent “unique examples of real people in real situations, investigate and report the real life, complex, dynamic, and unfolding interactions of events,

human relationships and other factors in a unique instance” (Cohen, et al., 2011, p. 289). The key consideration in using the case study method was to keep the research reasonable in terms of its scope (Baxter & Jack, 2008). Boundaries were established to restrict the breadth of investigation. The collection of data was limited to a timeframe, two schools, focused data collection activities; the analysis was guided by the research context and questions (Creswell, Plano Clark, Guttman, & Hanson, 2003; Miles & Huberman, 1994; Stake, 1995). This research deliberately focused on the individual, cultural, and institutional factors affecting the nature of technology education in two secondary schools (Hitchcock & Hughes, 1995).

Case study method was also chosen because it provided a means to present what was happening for the teachers of technology in secondary classroom settings. An embedded multiple-case design allowed me to consider the characteristics of each school context separately and utilise the different data collection methods of choice. The data consisted of observational, self-report, and teacher-generated resources to compare the circumstances in two different schools. The reasons for choosing these two schools are described in the next section.

4.2.1.1 The case study sites

Lakeside Academy was initially chosen as a single school for study because of its convenient location (Creswell et al., 2003; Merriam, 1998) and because there was a newly appointed Head of Faculty (Bernadette) who had a nationally established reputation for her contributions to the subject over two decades. Bernadette had indicated that one of the key priorities in this new role was to consolidate shared understandings of the purpose and enactment of technology education at both school and department level. She aimed to foster technology teachers’ understandings through professional learning practices. Initially four teachers in Lakeside Academy (Bernadette, Colette, Helen, and Mike) agreed to be participants in the research.

Unfortunately, the Head of Faculty became ill during the data collection phase, and this led to some delay and uncertainty as to whether she would return to work or continue to be involved in the research. With concerns around her health, and when Colette successfully gained a position elsewhere, I made the decision

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expand my research, to include another school. Greenhill School was also convenient in terms of its location. During this time and without my knowledge, Colette (from Lakeside Academy) had been appointed at Greenhill School.

Greenhill School was entering an establishment phase because it was newly built. The curriculum was to be interpreted in a context where teachers had not previously worked together. This provided a unique opportunity to explore a future-focused approach to curriculum in a context where teachers were encouraged to think creatively about their practice, and where there would be fewer historically placed constraints. After my attendance at the first department meeting Colette expressed her intention to continue with the research. She also suggested a second interview to record her observations since her transition from Lakeside Academy to Greenhill School.

The data collection period spanned 18 months between the two schools. Lakeside Academy had a less intensive but longer data collection phase than Greenhill School, which was visited more regularly over a shorter period of time. Alice, Bernadette, and Graham were purposefully chosen for their reputation as effective teachers of technology and Colette, Helen, and Mike were volunteers and had expressed an interest in being involved because it might support their evolving understanding of the technology curriculum. A summary of each case study site is provided in Table 8.

Table 8. A summary of each case study site

School information	School vision	Research participants	Area of technology and responsibilities
Lakeside Academy Opened in 1960 800 students	Academic excellence, fostering personal growth and occupational preparedness	Bernadette	Hard materials Head of Faculty
		Helen	Teacher in charge of food technology
		Mike	Teacher in charge of digital technology
Greenhill School Opened in 2015 600 students	Emphasises cultural locatedness, community involvement, and contemporary pedagogies	Alice	Product design Curriculum leader of technology
		Colette	Teacher of hard materials/product design
		Graham	Teacher in charge of food technology

The following section describes each school.

4.2.2 Lakeside (Hoki Kaipuke) Academy

Lakeside Academy was established in the early 1960s with a reputation for academic excellence. It has a roll of approximately 800 students. The school's last Education Review Office (ERO) report indicated that the character of the school remains central to the ethos of the teaching, which was reflected in the strength of relationships between whānau (family), staff and students, and in the curriculum offered to meet learners' needs. Students were reported by ERO to receive appropriate advice about career pathways and academic results were at or above those of students in similar schools for the National Certificate of Educational Achievement (NCEA) at Levels One and Two. Teachers were described as maintaining positive and supportive classroom environments and as using effective strategies for promoting educational success. On its website, the school communicated an intent to facilitate learning, to enable students to become contributing citizens in society, and to foster personal growth and occupational preparedness.

In 2002, the school opened a purposefully designed technology education centre, which had specialist facilities for food, materials technology, and graphic design. Anecdotal knowledge of the technology department (before the research began) suggested that in general, teaching emphasised occupational preparedness rather than the development of students' critical thinking. The newly appointed Head of Faculty indicated that she was the exception in this department. She was indeed known in the technology community because she had embraced the technology curriculum (MoE, 2007) within her specialist area of hard materials and for her effective classroom practice.

In 2016, the school's website celebrated the technology department's contribution to the teaching of the New Zealand curriculum (MoE, 2007). Emphasis was placed on the progressive and innovative nature of the subject, and learning was reported as being focused on the development of independent and creative thinking skills, through students' exposure to problem solving activities, engagement in the making of products or systems, and with a view to making a difference to society.

4.2.2.1 *The participants*

As indicated earlier, there were initially four teachers who agreed to become participants at Lakeside Academy. Their professional experience and interest in the research is outlined next. Pseudonyms are used for each of the teachers.

4.2.2.1.1 *Bernadette*

Bernadette was an experienced New Zealand teacher, having been in the profession since 1990. She had been a teacher of workshop technology, design technology, and more recently, technology education. Bernadette had a national reputation for her involvement in the development of the technology curriculum (MoE, 2007) at both policy and practice-level and had recently been appointed as the Head of Faculty. She encouraged my attendance at department meetings but suggested that my contributions would only be welcome when she prompted them, and if they did not undermine her evolving relationships with her staff or authority as Head of Faculty.

4.2.2.1.2 *Colette*

Colette was an Australian trained history teacher who had taught overseas for over 20 years. During that time she had developed an interest in working with wood and gained a Certificate in Cabinet Making so that she could teach design and technology in Australia. It was Colette's first year of teaching technology education in New Zealand and she expressed an interest in developing her understanding of the curriculum, with a view to contextualising her teaching practice in this country.

4.2.2.1.3 *Helen*

Helen was originally from South Africa and had a background in home economics. She had held a variety of roles overseas, as a technician in a University of Technology and later as a lecturer of home economics. Home economics in New Zealand is situated within the Health and Physical Education curriculum and is derived from manual training (Street, 2006). Helen had experience of teaching from New Entrant to Year 13 level and had secured a position at Lakeside Academy five years previously to teach science and junior food technology. Since then, she had also started teaching and hospitality at

NCEA Level One. Helen indicated a motivation to develop her understanding of technology education.

4.2.2.1.4 Mike

Mike began teaching after a career in the military where he was an electronics specialist. After leaving the military, he had been an unqualified teacher in the United Kingdom before moving to New Zealand, then gaining a scholarship to study and qualify as a technology education teacher. Mike was the teacher in charge of digital technology in his second teaching post in New Zealand. He wanted to be involved in the research to gain affirmation that the work that he was doing adhered to the curriculum requirements.

4.2.3 Greenhill (Pukepuke Matomato) School

Greenhill School was a newly established junior high, and there was emphasis on its cultural locatedness. In New Zealand, cultural locatedness is a means to recognise identity, language, and culture, and derives from a Māori worldview (New Zealand Education Council (NZEC), 2011). The school roll began in 2016 with nearly 600 students in Years 7 to 10. It was promoted as an Innovative Learning Environment, with an emphasis on positive student welfare. Learning in this school was described as being goal focused to support students' holistic development and skills in self-regulation. Learning opportunities were co-constructed between two to three specialist teachers (called Co-teachers) from two differing learning areas. The overarching aim was to be responsive to students' needs and interests. Throughout each semester students in Years 7 to 10 were given a choice of options, with the constraint that at some point during the academic year, they had focused both on mathematics and English.

Whilst there were specialist technology teachers on staff and a purposefully designed physical space, the department was still in its establishment phase. Anecdotal evidence (prior to data collection) suggested that an initial emphasis on independent learning and critical thinking had contributed to a lessened focus on the establishment of classroom routines.

4.2.3.1 *The participants*

In Greenhill School there were three teachers who were participants in the research, including Colette who had transitioned from Lakeside Academy to Greenhill School during the data collection phase.

4.2.3.1.1 *Alice*

Alice had been a teacher in New Zealand for 22 years. Most of her experience was based in one school, teaching graphics and hard materials, but she had recently secured a position as specialist leader of product design and the junior technology curriculum. She was known at a national and local level for her understanding of design, as applied in technology education. Alice stated that she was keen to work collaboratively throughout the research process to establish a shared vision for the newly acquainted teachers and to establish the nature of technology education within this new school context.

4.2.3.1.2 *Graham*

Graham had been a chef before entering the teaching profession. He had acquired a Scholarship to study teaching and after completing his Diploma secured a position as a food technology and hospitality teacher in a high school. Graham was currently in his third school and had been teaching for five years. His current role was as a specialist teacher of food technology in this junior high school.

The next section introduces the methods of data collection used in this research.

4.3 Methods of data collection

By using multiple data collection techniques within case study research, a more convincing and nuanced representation of the context was presented (Casey & Houghton, 2010). In this research, data collection relied on several primary sources; namely, the New Zealand curriculum document (MoE, 2007) and its supporting materials (MoE, 2010), two or three semi-structured interviews, non-participatory lesson observations, department meetings, teacher reflections, and teacher-generated resources. The next section describes each of the data collection methods in more detail.

4.3.1 Observational research

Observational methods in qualitative research provide an opportunity to explore participant behaviours and dialogue - to observe and record what people are both saying and doing. Observational methods are a form of naturalistic research to accommodate inquiry into the systematic practice of participants in their own setting (Mays & Pope, 1995). Observation is the most effective way to consider whether what people espouse is what they do in practice, rather than relying on what they describe or perceive to do (Moggridge & Atkinson, 2007). Observation can provide first-hand insight into the needs, desires, and habits of participants - concepts that participants might not be able to explicitly articulate. My research used a “fly on the wall” approach (Moggridge & Atkinson, 2007, p. 673) to facilitate observation and a record of teachers’ actions, without interfering in their own context. This enabled the collection of situated data so that I could corroborate the self-reported accounts from the interviews (Anderson, 2010). The process allowed me to form impressions and yield authentic data with a view to represent participants’ realities (Lincoln & Guba, 1985) because

Our observations simply verify an already existing reality... Our perceptions of reality will, consequently, appear somewhat contradictory, dualistic, and paradoxical. The instantaneous experience of the reality of *Now* [Emphasis added] will not appear paradoxical at all. It is only when we observers attempt to construct a history of our perceptions that reality becomes paradoxical. (Wolf, 1981, p. 127)

To accurately represent participants’ inner worlds, it was important to consider the potential “Hawthorne Effect” during my observations, where teachers might change their behaviours because I was observing their practice (Kuper, Reeves, & Levinson, 2008). For example, my presence during lesson observations might have affected the participants’ actions initially but by adopting a non-participatory role teachers appeared to naturally immerse themselves in their classroom practice. I also mitigated this effect by comparing whether teachers’ (self-reported) espoused theories correlated or contradicted with their practice both in a classroom environment and during professional learning activities (Berg, Ridenour Benz, Lasley, & Raisch, 1998; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). This provided insight into how teachers’ perceptions translated into their practice, or if their attitudes towards technology

education were moderated as a result of the professional interactions or institutional constraints in their sociocultural context.

Focused observation is a means of narrowing a research perspective to highlight issues that might otherwise be overlooked (Ritchie, Lewis, McNaughton Nicholls, & Ormston, 2013; Spradley, 1980). The observations were used to build upon the perception-based data from the semi-structured interviews and to support the development of a “thick description” of the research context. The provision of a thick description provided insight into “context and meaning as well as interpreting participant intentions in their behaviours and actions” (Ponterotto, 2006, p. 541).

I collected data about the nature of the activity occurring, resource use, and the interactions between participants (Le Compte & Preissle, 1993). This data provided examples of school-based discourse and supported my understanding of what knowledge was valued by the community in relation to the teaching of technology education. The lesson observation and department meetings were videoed in order to allow me to get a sense of the “bigger picture”, with a view to apply these impressions during the data analysis (See Section 4.6) (Jewitt, 2012). To further guide data collection, an observation sheet was used for the lesson I attended (Appendix A). This was developed to record teachers’ actions and there was a particular focus on the terminology used - particularly during the teacher’s introduction to the lesson, as the research focus explored teachers’ understanding of and a familiarity with the curriculum (MoE, 2007). During the lesson and in my role as a non-participant observer, the nature of the physical context, (such as a workshop), the pedagogical strategies being used, and the types of interactions between students and teachers were also recorded. The observation sheet was designed to identify factors that participants’ emphasised in their practice to later compare with teachers’ self-reported perceptions of the nature of technology education.

During the department meetings, I was interested in the emphasis placed upon curriculum meaning in each sociocultural context because “a speech situation has a double structure, the propositional content [what is being said] and the performatory content [what is being done]” (Cohen, et al., 2011, p. 450). Whilst each action could have been considered for its validity, veracity, appropriateness,

honesty, and understanding (Habermas, 1978), a socio-cultural perspective assumes that a teacher's actions are mediated by the context and their subjective stance. The observations therefore centred on the nature of dialogue - in particular, who was taking part in the discussions and for how long, the differing identities and characteristics of the participants, and their apparent membership in the group as defined by conversations about technology education.

The observational data represented two key areas of focus. The first was how teachers' actions in the classroom reflected understanding of the curriculum (MoE, 2007). Secondly, I was interested in seeing whether participants communicated alternative understandings as a result of their interactions during department meetings. This provided a means of cross-checking data, to triangulate sources and determine whether the evidence converged (See Section 4.6). The process for collecting data during the lesson and department observations is described in the next section.

4.3.1.1 Lesson observations

Each teacher was asked to propose a lesson that could be observed. In general, and for the participants' convenience, the observation was conducted immediately after their baseline interview. During each lesson, the class level, task, terminology used, teacher-student interactions, and dialogue used during the practitioners' introductions were of particular interest (Appendix A). The intent here was to develop a "systematic description of events, behaviours and artefacts in the social setting chosen for the study" (Marshall & Rossman, 1989, p. 79). Artefacts are defined as being a form of visual data, to represent reality, and then be interpreted by the viewers (Cohen, et al., 2011; Flick, 2009).

During the lesson observation, artefacts referred to the classroom layout and resources used, which shaped my interpretation of the organisational culture of the school setting (Schein, 1996). This was pertinent because the first school had a reputation for its traditional approach to education while the second was an ILE, and was being marketed for its future-focused approach. I was interested to know whether artefacts appeared to make a difference to teachers' practices in technology education. After the lesson observation, the teaching focus and content

were tracked to determine at which level of the curriculum they were aimed and which strands and components had been addressed (MoE, 2007).

4.3.1.2 Department meetings

Attendance at department meetings was arranged when the curriculum leaders indicated that professional discussions would be of benefit to my research focus. During these sessions, the themes of the discussion, the activities and the interactions between the teachers were all of interest (Lodico, Spaulding, & Voegtle, 2006). In particular, those participants who were silent as well as those who shared their views might be indicative of power differentials within the department's sub-culture. By video recording the department meeting, the nature of the conversation as well as the non-verbal communication could be captured. There was particular interest during these meetings on the ways that teachers appeared to be making meaning of the concepts being discussed, how they communicated their thoughts, and the language that they used to mediate this process. To corroborate individuals' perceptions, self-report methods were used.

4.3.2 Self report data: Collecting personal insights

Self-reporting is a method used in medical disciplines to encourage individuals to reflect on their subjective wellbeing but it can present difficulties as related to bias - specifically that participants may recall experiences based on their current emotional state rather than representing the true reality of an event (Stone & Shiffman, 2002). Whilst this view is acknowledged and could be argued as a persisting concern in any self-report method, the research was intentionally designed to generate understanding of participants' version of events or constructed understandings, to acknowledge that there is no objective, absolute reality or truth (Kelly, 1955). Participants were encouraged to reflect on their own perception of the truth, and self-reporting was deliberately chosen as a means to enable this process. Throughout the data collection process therefore, I re-iterated my interest in each teacher's individual stories, experiences and perceived truth (Miller & Glassner, 1997).

To collect sustained evidence of teachers' perceptions of the nature of technology, participants were initially asked to reflect upon their evolving practice through the use of a Diary Cam. It was immediately evident that there was resistance to this

means of data collection, perhaps because of the perception that this would require them to develop new (digital) understandings, or that it would be time consuming and intrusive. As an alternative teachers were provided with the option of either providing written reflections (via email) or having another interview. All participants, apart from Colette, used the email method once. Bernadette, Colette, and Helen of the also opted for an additional interview. The use of semi-structured interview is discussed in the next section.

4.3.2.1 Semi-structured interviews

Interviews were initially selected to establish or consolidate trusting and reciprocal relationships with each participant and to foster a research environment, which was conducive to the sharing of teachers' personal experiences (Luttrell, 2010). An interview of this nature can be viewed by some as a form of polite interrogation and can lead to some delicate situations (Kellehear, 1996). Therefore it was important to emphasise my interest in having a conversation about each teacher's personal experience, perceptions and understandings of technology education, and to mitigate the risk that participants might adapt what they were saying to suit what they perceived I wanted to hear (Walford, 2001). I was cognisant of participants' apparent emotions, tone, and non-verbal communication. It was also important to be conscious of the potentially artificial nature of the interviews, and I managed the time constraints carefully with a view to maintain both positive relationships and an affirming experience (Anderson, 2010; Myers & Newman, 2007).

Conversely, semi-structured interviews were purposefully selected because of their flexible and intrusive nature and because they are suited to bounded and interpretive research (Drever, 1995; Jarratt, 1996). Semi-structured interviews were considered a means to encourage participants to share their worldview of the nature of technology education and provide the opportunity to use language familiar to technology educators - I offered clarification, as required. I provided the questions to participants before we met but there was the opportunity for improvisation, to explore the personal experiences of each teacher, who were encouraged to share information or data outside of the focus of the research (Fontana & Frey, 2000). Such an approach acknowledged the nuanced nature of each socio-cultural setting.

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Whilst the order of each interview was guided by pre-determined and previously shared questions (See Appendix B), there was still the flexibility to probe teachers' views, to obtain deeper insight, as necessary (Creswell, 2012; Cohen, et al, 2011; Menter et al., 2011). The questions used were open-ended and indirect in nature, to accommodate participants' differing views (Kerlinger, 1970).

To explore participants' perceptions, teachers were asked whether they thought there were any discrepancies between the intent of the New Zealand curriculum (MoE, 2007) and the reality of teaching these concepts within their school context. They were asked to share their thoughts about the nature and position of technology education in New Zealand and discuss what they believed should be taught in technology education, when and how. Finally, they were asked to describe the strategies they used to familiarise themselves with the curriculum, to develop resources and keep their practice current. Any data that was highlighted, by the participant or me, as being delicate in nature was handled sensitively during the research process and acknowledged as being confidential in nature. I was cognisant that some of the participants were sharing information that might be perceived as derogatory about their school or colleagues. I have taken care to report this data in a considered manner, with a view to minimise the risk that my research could cause them professional harm.

During phase one of the data collection process there was one semi-structured interview per participant. The rationale for this meeting was to generate a baseline of understanding through the self-disclosure of each teacher's perceptions. The semi-structured interview was used so that data could later be used to corroborate or contradict my observations and other data sources. Each interview lasted approximately forty minutes and was recorded and transcribed to allow for the verification of the record (Creswell, 2012; Kvale, 1995). The participants were provided with their transcripts after each interview, to confirm that it was a true and accurate representation of our discussion.

The conventions followed for transcription included the use of pseudonyms, indications of breaks or pauses in speech, and the use of the term "together" (during department meetings) to indicate when people were all speaking at the same time. Non-verbal activity was also acknowledged, such as a teacher clicking

her fingers to gain student attention. Line numbering was used during the transcription process for reporting purposes (Flick, 2009).

There was one other pre-determined opportunity for an interview, which was planned towards the end of the data collection phase. During this meeting participants were asked to describe any new experiences or changes in their thinking. They were also asked to verify the accuracy of the lesson observation data through respondent validation (Appendix E). This approach strengthened the research design because the opportunity was used to interrogate my own observations and be responsive to each participant's circumstances (Cohen, et al., 2011).

Throughout the data collection process, teachers were asked to note and reflect upon their evolving thinking and practice. Three participants opted for an additional interview during this time. To gain additional insight into their practice, teachers were also asked to share any resources that they had developed during the data collection phase of the research.

4.3.3 Respondent generated resources

Teacher-generated resources were considered in this research context to be both emic and etic in nature. The emic perspective considers the insider's point of view - in this case the secondary technology teacher. An etic perspective can explore ecological factors that are not necessarily salient to the participants (Harris, 1974; Morris, Leung, Ames, & Lickel, 1999). The teacher-generated resources were considered to be reflective of participants' understanding of the curriculum and also provided insight into the dominant discourse in the school (Cohen, et al., 2011; MoE, 2007). In this research, I was interested in exploring how teachers were using resources in their classrooms to support the enactment of technological concepts. I was cognisant of the intended purpose of the teacher-generated resource, its audience, when it was made, its function, and the value attributed to it by the teacher or other colleagues (Cohen, et al., 2011). When representing teachers' circumstances, the teacher-generated resources were either described or images were provided (See Section 5.3). The only resources collected were those volunteered by each participant. This research adhered to quality assurance and ethical considerations as outlined in the next section.

4.4 Ethical approval and trustworthiness

Ethical approval for this research was obtained from the University of Waikato's Ethics Committee, and then informed consent was obtained from the participants. Initially the intent was to only explore one school but when the Head of Faculty in that setting became unwell and Colette moved from Lakeside Academy to Greenhill School, the research was extended to two schools (See Revised Ethics Application - Appendix C & D). The trustworthiness of the research project was assured by adhering to the notions of dependability, credibility, and transferability - each of which is discussed in turn (Lincoln & Guba, 1985).

4.4.1.1 Dependability

Dependability is defined as a means of “taking into account both factors of instability and factors of phenomenal or design induced change” (Lincoln & Guba, 1985, p. 299). During the data collection phase for example, I saw Colette's move as an opportunity for mutual simultaneous shaping and to gain deeper insight into the research context. Mutual simultaneous shaping is an alternative to the quantitative notion of causality and acknowledges that

everything influences everything else in the here and now. Many elements are implicated in any given action, and each element interacts with all of the others that change them all, while simultaneously resulting in something that we label as outcomes or effects. But the interaction has no directionality, no need to produce that particular outcome. (Lincoln & Guba, 1985, p. 151)

From this perspective, Colette's transition to a new school offered the potential for new insight into her practice in a different social setting.

Throughout the data collection phase of the research, participants were provided with opportunities to reflect critically upon their social context to allow them to represent the factors influencing the changing nature of technology education in their school. These opportunities for reflection were recorded during the interviews or via email and allowed participants to describe their changing attitudes and explain recalled events or comments that had been made during department meetings, the interviews or the lesson. Such an opportunity was particularly pertinent for Colette to represent her particular circumstances.

4.4.1.2 Credibility

Naturalistic research draws attention to the notion of truth - in this case ethically and in relation to participants' beliefs about the nature of technology education. The techniques to ensure findings are viewed as credible might include "prolonged engagement and persistent observation, triangulation, peer debriefing, negative case analysis, and member checking" (Lincoln & Guba, 1985, p. 219). The processes I used checked descriptions, explanations, and the interpretation of data (Maxwell, 2005). When reviewing different parts of the data, patterns in results were sought to ensure that the findings and interpretations could be truthfully communicated - explanations are supported with evidence. Multiple sources and kinds of evidence were used and triangulated to address the research questions and care was taken to, as far as possible, avoid bias and acknowledge my own prejudices and suspicions. Triangulation by data type was used as a means to substantiate and improve the credibility of my findings (Miles, et al., 2014). This mitigated the risk that there might be shortcomings with individual methods and facilitated propositions based on two or more methods of data collection (Lincoln & Guba, 1985).

It was imperative that I was accurate in my descriptions within the multiple case studies in order to represent the participants' truth by being consistent, neutral, and credible during my interpretations (Onwuegbuzie & Johnson, 2006). The accuracy of data was ensured through respondent validation where transcripts of all interviews and department meetings were sent to the participants, to confirm that the dialogue was a fair representation of discussions (Torrance, 2012). Respondent checks were also conducted at the end of the data collection phase in relation to the inferences that I had drawn and the conclusions that I had made about teachers observed practice (See Appendix D) (Bloor, 1978; Cohen, Manion, & Morrison, 2011). During the final interview, participants watched the video recording of the introduction to their observed lesson, and this was used as a means of eliciting responses about teachers' actions.

My practice aligned with the concept of beneficence where it was my responsibility to ensure that participants' engagement in the research did not impact on their professional welfare as a result of the additional workload or in the way that I reported findings. Where feasible and as far as possible, any risk of

identifying participants has been minimised by ensuring that names and personal details are never openly disclosed, by using pseudonyms and changing some gender roles with a view to maintaining anonymity. It is important to note however, that because there were only two schools, both in the same region, it is possible that participants were aware of others' engagement in the research. Equally, technology education is a small community, and it is possible that the participants' descriptions might make them recognisable.

I am confident that the findings are not just the result of my own interpretations but are also recognisable to other researchers. During the data analysis phase, a sample of data was shared with a peer researcher who analysed it then critiqued my interpretation (See Appendix G). Throughout the data collection and analysis phase of the research, I maintained a "reflective commentary" (Shenton, 2004, p. 68) and encouraged peer scrutiny of the research project - both from my supervisors during regular meetings and through publications and feedback from conference and seminar presentations.

4.4.1.3 Transferability

Transferability in naturalistic research is a means to communicate the context of my research through the provision of a "thick description" (Lincoln & Guba, 1985). Thick description can emerge from exploratory case studies to promote the credibility of a research project and provide the reader with insight into the issue being considered - even if they are not familiar with the discipline (Shenton, 2004; Yin, 2009). It is not merely a means to provide detail about the research phenomenon; it also offers insight into social action for the purposes of interpretation (Geertz, 1973; Ryle, 1949; Schwandt, 2001). Thick description requires understanding of a research context and the factors affecting participants' actions - in this case, teachers' practice (Ponterotto, 2006). A thick description

... Does more than record what a person is doing. It goes beyond mere fact and surface appearances. It presents detail, context, emotion, and the webs of social relationships that join persons to one another. Thick description evokes emotionality and self-feelings. It inserts history into experience. It establishes the significance of an experience, or the sequence of events, for the person or persons in question. In thick description, the voices, feelings, actions, and meanings of interacting individuals are heard. (Denzin, 1989, p. 83)

Thick descriptions can provide a deeper and nuanced perspective of a phenomenon. This approach can support researchers to assess how typical a situation is, within a context or for participants, and provide indications as to how these circumstances might translate into another setting (Eisenhart & Howe, 1992). This research was intentionally designed to explore how teachers' perceptions influence their engagement with the New Zealand curriculum (MoE, 2007), and thus the research could be deemed as being limited to educators only. The next section describes data collection method.

4.5 Data collection

Each teacher was interviewed at the beginning of the data collection phase to obtain baseline information about their teaching experience and to gain some insight to their differing perceptions of the nature of technology education (Appendix A). Four participants requested that their lesson observation occur immediately after the baseline interview (Appendix B). Teachers were asked to reflect upon their practice at the mid point of the data collection phase. Bernadette, Colette, and Helen completed both a written response and a second interview. Alice, Graham, and Mike opted to complete a written reflection.

Teachers were asked to provide evidence of the resources they generated throughout the data collection phase of the research. For example, Colette provided resources developed as the result of the professional development in which she was involved and Graham shared his resources via Google documents the day before his lesson observation. Bernadette, Helen, and Mike provided their resources at or after their second interview, and Alice did not share any teacher-generated resources.

There was a final interview after the data analysis phase for the purposes of respondent validation, to ask some further questions, gain clarification, and to confirm my impressions (Appendix E). This was significant because it provided participants with the opportunity to signal whether their thinking or practice had evolved throughout the data collection phase or as a result of their engagement with the research. The quantity of data collected is outlined below in Table 9.

Table 9. The quantity of data collected from each participant

	Interview (Time)	Lesson observation (Time)	Department meetings (Time)	Teacher Reflections (Type)	Teacher generated resources (n.)
Alice	1) 20.01 2) 48.11	25.10 total 8.06 used	1) 55.36 2) 54.14	1 Written	N/A
Bernadette	1) 31.57 2) 20.35 3) 33.09	29.22 total 13.08 used	129 mins.	1 Written Extra Interview	4 worksheets
Colette	1) 50.43 2) 30.11 3) 75.00	53.09 total 12.02 used	1) 55.36 2) 54.14	1 Written Extra Interview	3 worksheets
Graham	1) 25.41 2) 32.14	28.56 total 14.30 used	1) 55.36 2) 54.14	1 Written	1 worksheet
Helen	1) 33.48 2) 27.34 3) 36.34	44.37 total 10.33 used	129 mins.	1 Written Extra Interview	3 workbooks 2 worksheets
Mike	1) 43.33 2) 28.42	54.45 total 21.55 used	129 mins.	1 Written	4 worksheets

The amount of data used from the lesson observation was determined by its quality and significance. Data were triangulated with a view to draw converging conclusions or to reconcile differences in the results presented (Miles, et al., 2014). The next section provides more detail about how the data was analysed.

4.6 Data analysis

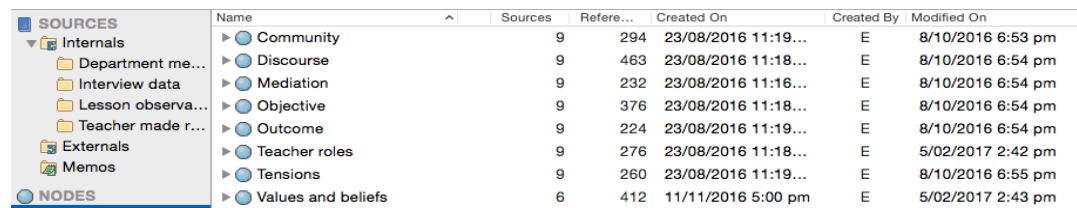
Data analysis followed a sequential process whereby the data was collected, and findings were recorded and coded (Miles, et al., 2014). The stages of data analysis occurred concurrently with data collection (Cohen, et al., 2011). I used the key themes from the research questions as the framework for my analysis - teachers' perceptions, interpretation, and enactment of the curriculum (MoE, 2007). Data were organised accordingly with a view to match, contrast, and aggregate the findings. The presentation of data aligned with Miles and Huberman's (1984) recommendations that data should be organised carefully to facilitate their reduction and selection.

Consequently, interview transcripts, lesson observations (including video data), department meeting transcripts, teacher generated resources, and reflections were all imported into Nvivo 11. Nvivo software is suitable for qualitative data analysis because of its ability to process large sections of written text. Both inductive and deductive coding methods were used. Inductive coding was determined by the

CHAPTER FOUR: Research Design, Methodology, and Analysis

emerging themes, and NVivo was used to organise text into codes. I also used deductive coding to align the qualitative data with the research questions' key terms - including perceptions, curriculum interpretation, and enactment (Fereday & Muir-Cochrane, 2006).

For example, emerging themes were identified from the interview transcripts then linked to the research questions, with a view to extrapolate implicit and explicit themes within the data (Bazeley, 2007; Guest, MacQueen, & Namey, 2012). Nvivo 11 was used to both organise and analyse the data. One of the benefits of Nvivo is that it can be used to cross-check data, to determine whether more than one category is being addressed, to display data in different ways for the purposes of interpretation, and to establish the incidence of data (See Section 5.2) (Le Compte & Preissle, 1993). This data was organised into Nodes (Nvivo's term for themes), as illustrated in Figure 4.



SOURCES	Name	Sources	Refere...	Created On	Created By	Modified On
Internals	Community	9	294	23/08/2016 11:19...	E	8/10/2016 6:53 pm
Department me...	Discourse	9	463	23/08/2016 11:18...	E	8/10/2016 6:54 pm
Interview data	Mediation	9	232	23/08/2016 11:16...	E	8/10/2016 6:54 pm
Lesson observa...	Objective	9	376	23/08/2016 11:18...	E	8/10/2016 6:54 pm
Teacher made r...	Outcome	9	224	23/08/2016 11:19...	E	8/10/2016 6:54 pm
Externals	Teacher roles	9	276	23/08/2016 11:18...	E	5/02/2017 2:42 pm
Memos	Tensions	9	260	23/08/2016 11:19...	E	8/10/2016 6:55 pm
NODES	Values and beliefs	6	412	11/11/2016 5:00 pm	E	5/02/2017 2:43 pm

Figure 4. The emerging themes from the data

Open coding was used to establish the meaning emerging from the data (Corbin, & Strauss, 1990). The use of Nvivo was perceived to improve the trustworthiness of the research because it enabled the consistent management, coding and retrieval of information (Kelle & Laurie, 1995). Analysis and reporting of findings needed to capture the teachers' differing perceptions of their context to represent both etic and emic analysis. To determine this, there was initial analysis of the interview data to establish teachers' ontological beliefs, values, and epistemological views of the nature of subject from a local and wider perspective.

Data coding followed a process whereby each data set was entered and formatted, coded, and annotated where necessary. Data were compared to determine consistency, integrated, and organised into a category, such as teachers' values and beliefs. Dendograms were used to compare the node results, to illustrate relationships between data sources and as a means to inform analysis (Appendix F). Next, data were compared, through the process of triangulation. A combined

level approach to the triangulation of multiple sources was taken because individual, group, and organisational data were pertinent to the research focus. Activity theory was also used as the interpretive framework and is discussed in the next section.

4.6.1.1 Activity theory

Activity theory was the interpretive framework used for the lesson observations and department meetings to make meaning of the differing socio-cultural contexts (See Section 3.3.1). According to Rogoff (2008) there are three planes of sociocultural analysis, which are personal, interpersonal, and institutional in nature. All data were considered in relation to the differing aims and goals of each activity. For example, the lesson observation considered the personal plane - such as the teacher's aims for learning. The department meeting explored an interpersonal perspective and then finally the two school contexts were analysed at the organisational level.

Activity theory was used to understand the descriptions of each relevant sub-system, which included the mediating artefacts, community, subjects, rules, division of labour, objects and outcomes (Engeström, 2001). The interactions within and between these elements supported the exploration of relationships during an activity in a particular setting, as well as how the activity was mediated and constantly changing. The sub-activity systems are illustrated in Figure 5.

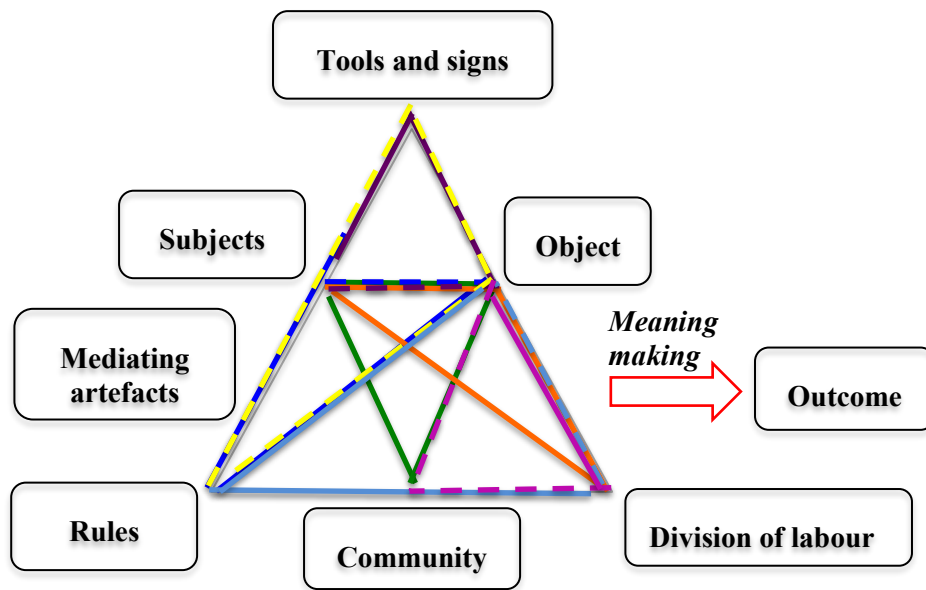


Figure 5. Sub-activity systems

Based on Engeström's (2001) model

Key

- Division of labour → community → object
 - Division of labour → rules → object
 - Rules → tools and signs → object
 - Subject → community → object
 - Subject → division of labour → object
 - Subject → rules → division of labour
 - Subject → rules → object
 - Subject → tools and signs → object
- Contradictions Primary ① Secondary ② Tertiary ③ Quaternary ④

Socio-Historical **SH**

There are correlations between the elements in the way that they interact to inform sub-activity systems and the manifesting contradictions that can emerge. As identified in Chapter three, these contradictions are categorised into four levels. Primary level contradictions are positioned within the elements and connected to the influence of political agenda. Secondary contradictions can occur between

elements and identify factors impacting the teachers' practice. Tertiary contradictions highlight tensions in practice that provide the potential for change. The quaternary level illustrates the commonalities between the external activity systems. All of these contradictions were used to analyse the nature of technology education from the different teachers' perspectives but also across social settings (Engeström, 1987).

Activity systems were used to determine the diverse nature of technology education. The notion of multivoicedness aligned with the research design, which presented diverse perspectives, interests, and discourses to facilitate the identification of emergent tensions and the potential for innovative practice in technology education (Engeström, 2001). The differing school contexts were represented through their historicity and to consider how practice was constructed or transformed in light of the subject's technical roots. Contradictions highlighted opposing views and actions, which identified tensions in practice and provided insight about the potential for future change.

The final phase of data analysis required the interpretation of all evidence to identify patterns, to explain their pertinence and make propositions. To enable this process, activity system diagrams were developed to communicate the differing views, traditions, and interests, as represented by both the individual participants and the school contexts.

4.7 Chapter summary

This chapter provides an overview of the methods and research design used to collect and analyse data about teachers' perceptions and ways of interpreting and enacting the technology curriculum in two New Zealand secondary schools. It provides insight into the two case study sites and six participants' professional backgrounds and interest in the research. Also discussed are the processes used to ensure the trustworthiness of this research and the methods used to collect and analyse data. The next chapter presents the resulting findings for this research.

CHAPTER FIVE: FINDINGS

5.1 Introduction

This chapter reports the findings about each teacher's perceptions and manifesting practice as presented during their interviews, observed lessons, department meetings, and through the provided teacher-generated resources. Findings about teachers' values and beliefs, their aims, perceived roles and understandings of curriculum discourse, and meaning making in their school context are introduced. The characteristics of each observed lesson are interpreted through second-generation activity theory, with a view to focus on the object of the activity and teachers' goals or motivations (Leont'ev, 1978, 1981). Contradictions between teachers' espoused perceptions and practice are also presented.

To interpret and understand the impact of the differing school settings on teachers' practice, third-generation activity theory is used (Engeström, 2001). The nature of mediated professional learning, organisational structures, and teacher perceptions are all reported in reference to how they can support understanding of the nature of technology education. The findings indicate that there are persistent tensions that continue to influence technology teachers' pedagogical practice, which include community expectations and a propensity for teachers to emphasise the *Technological Practice* strand and deemphasise the *Technological Knowledge* and *Nature of Technology* strands of the curriculum (MoE, 2007). Five of the six teachers in this research communicated their understanding of the subject's potential in relation to problem-solving and innovative and authentic learning. All teachers indicated schools' organisational structures, community understandings of the curriculum, and perceptions regarding the purpose of technology were affecting their practice. The next section reviews the rationale for the research and presents an overview of the data collected.

5.2 Baseline interviews

In this section, the findings from the baseline interviews represent differing teachers' perceptions of the nature of technology as influenced by their professional experience. All participants had either one or two subsequent interviews, which are reported on later in this chapter. The number of interviews varied as the result of some teachers' hesitance to engage with a diary camera as a

means of data collection. Teachers opted instead for additional interviews or the provision of their reflections via email. Four themes emerged from the baseline interview including values and beliefs, objectives, teacher roles, and discourse.

5.2.1 Values and beliefs

To identify their values and beliefs, participants were asked for their opinions about teaching in the technology education community in New Zealand. Participants described their perceptions based upon professional experiences of curriculum interpretation and enactment. Some teachers asserted that technology education was still misrepresented in their local community because of a lack of knowledge and as a result of the way that the subject had evolved. The sub-themes of attitudes, ideologies, opinions and valued knowledge, strategies and rules of practice are described. The teachers' schools are identified as Lakeside Academy (S1) and Greenhill School (S2) (Pseudonyms).

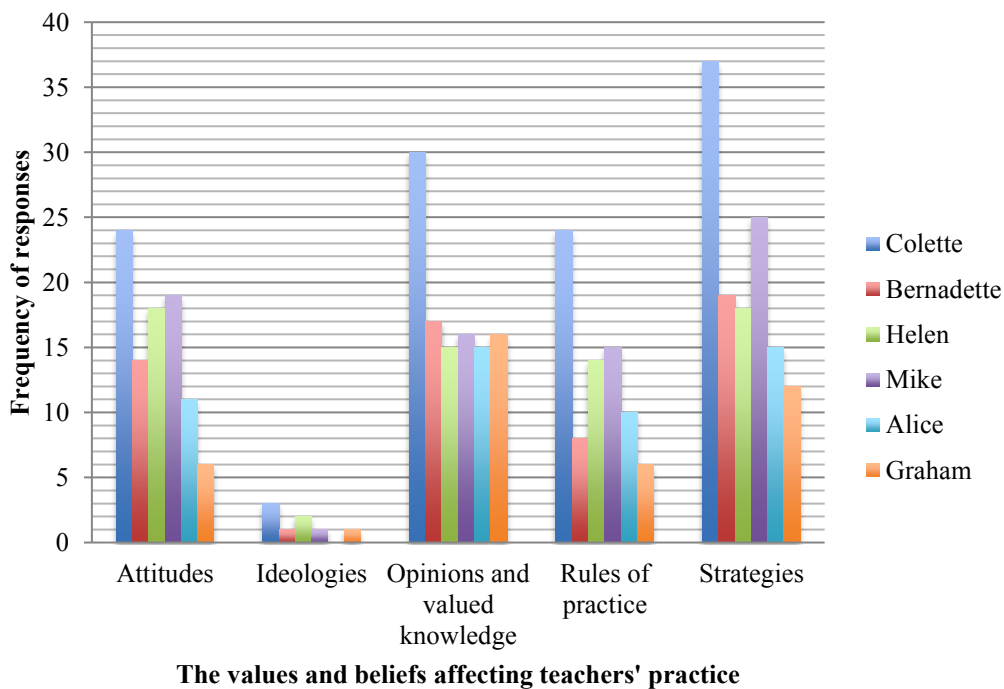


Figure 6. The values and beliefs affecting teachers' practice

All participants described their attitudes and espoused perceptions of the purpose of technology education either in their school or as a result of their professional experience. There was limited evidence to suggest that teachers had reflected upon how their perceptions might influence the way that they interpreted or enacted the curriculum.

5.2.1.1 Attitudes

All teachers described differing attitudes about the nature of technology education, how they perceived the subject could benefit learners, and the way it was being taught in their schools. For example, Alice (S2) described how the focus in their school was to foster a future-focused climate of learning, where

We want our students to be able to solve problems and make stuff, to... make a difference to them, to the community, to the world [to] present that to an authentic audience... That's really powerful, rather than taking a pencil case home and mum and dad say "That's nice". (Baseline Interview E, Line 200)

In contrast, Helen (S1) described a differing approach. She had noticed that her students were now coming to high school with prior exposure to technology education, meaning that what she had taught previously required some revision in order to address their needs. She stated

One thing that I've really noticed lately, is that kids are coming in from Intermediate having very high expectations. Now I know that there's some that don't have any expectations at all... I always take on board what a kid will come up to you and say [sic], sort of confidentially.

And one boy came up to me the other day and he said, "Miss, you know, I'm just - I hope you don't mind, but I'm just finding Food Tech. so unchallenging". And I said, "Well okay, let's see why". I said, "Where did you go?" 'Cause it's really good to see which teachers are doing such a good job that you're actually unchallenging. (Baseline Interview C, Line 338)

5.2.1.2 Ideologies

Technology teachers are likely to align with or be mediated towards four main perspectives, which are knowledge, socially, learner, or philosophically driven (Reinsfield & Williams, 2015; Schiro, 2008). Participants' ideologies were identified in relation to the nature of the subject and the action strategies that manifested as a result of their teaching. Bernadette (S1), Helen (S1) and Graham (S2) mentioned the values underpinning their practice most frequently. For example, Bernadette stated

I guess the most important thing is to get our Tech practice right. And you know, your Tech practice is, probably the part that people can use for the rest of their life, 'cause it's just part of life. But it's a good thinking through problem solving process that we use... So if I can do it practically, or using reality, that's a way that I like to do it. So we get

CHAPTER FIVE: Findings

out, and we touch, and we feel, and we play, and we bend, and we drill.
(Baseline Interview B, Line 25)

Helen (S1) explained that from her perspective her teaching was moderated by students' attitudes towards their learning. She stated

Some [students] are just slack... you can give them so many opportunities to fill in little things, and it just never really happens really. It is disappointing.

...They are really here, at the back of their minds, to cook... its at the back of their minds all of the time. Like, "Okay, well let's just get this paperwork over, have a good chatter, and then we'll get back to our next practical"... (Baseline Interview C, Lines 44 & 290)

Graham (S2) described what he perceived to be important in the teaching of the subject, stating

I think that all of the strands should be taught. I don't know the answer to when and how. When, how, I don't think that there is any one answer. I've only been around five years but I feel that I've seen so many different ways and there isn't an answer but I feel like that it really needs to be thought out and thought through but it also has to be a natural fit because if there is a group of students, for instance, who find a need or opportunity, or an inquiry-based [focus] and it's obviously very 'technology' then they should be running with it and we shouldn't be pushing certain aspects of the curriculum on to them if it's not a natural fit.

I feel that when you are teaching a technology project, it's very important to ask the right questions and so asking students things like how does it affect your project, what can you see are the alternatives in the future, and what ideas do you have on certain problems will spark certain ideas? (Baseline Interview F, Line 89)

5.2.1.3 Opinions and valued knowledge

The opinions expressed about technology education related to past curriculum implementation and what the participants felt had become valued knowledge.

Alice (S2) asserted that in her view

Technology is naturally an integrative curriculum and I guess from that there has certainly been the usual drama of going through the technology curriculum change and all the heartache that that causes. I've always been a little bit frustrated that we haven't made the progress that I perhaps think that we should of...

Sometimes I think is what we are trying to do too hard, and I don't think it is, my thinking is that what we've been trying to do is just too different to what the students and other teachers are used to and so

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everyone had put up their own barriers. Technology teachers have been just as bad as everyone else in putting up barriers in their thinking because you look at most teacher's programmes and they're not what's best for the student but they are actually what's easiest for them. (Baseline Interview E, Line 14)

Colette (S1 & 2) acknowledged the influence of societal change, but still valued skills and knowledge of equipment use, stating

Knowledge, as we know, in this day and age, is moving at such a pace that you couldn't possibly keep track of all of it... and particularly in technology... and so, in some ways, ignorance is an asset as a teacher

I do value skills and I must admit, like teaching the 'Building and Construction' kids at the older ages, at Year 11 and 12... I'm always amazed at their lack of skills, particularly with woodworking. They move into woodworking and they have very little hand tools skills and things like that to build on, so I guess in Australia, it was very prescriptive and [the students] had to be exposed to certain machines, certain tools and certain materials. (Baseline Interview A, Line 32)

5.2.1.4 Strategies

The strategies described by participants included ways in which they organised and supported students' learning. Alice (S2) talked about the need to ensure that technology education is understood by her colleagues and given the same priority as other subjects, in their newly established integrated curriculum. She stated

In the last three weeks we've just been getting to know the kids and this week we've gone into our learning modules where we are integrating the curriculum. There's myself and we have a maths specialist and then we have somebody else who was supporting the two of us, a non-specialist and the maths person was really, I want to do a maths lesson, we do so many.

I said "look I really want students to understand the context" and it took a really long time to get over what I was trying to do. [The other teachers] just didn't see it... it's partly my teaching style that I get out there and run with it and so I need to change that but now that people trust me, they can see where I'm going... I managed to get the students on board with the conceptual idea of, "this is technology and its based on values and it's extending our capability". (Baseline Interview E, Line 120)

Bernadette (S1) described her strategy to balance the theory with practical activities in the junior secondary school, stating

I think I have to get a balance between the theoretical side of it, and the practical side. To motivate my students. I've always been of the, of the mind that I can teach things to my students. I teach stuff to my students

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but I've got to make sure I do it properly. So if I can do it practically, or using reality, that's a way that I like to do it. So we get out, and we touch, and we feel, and we play, and we bend, and we drill. (Baseline Interview B, Line 185)

Colette (S1 & 2) described her strategy for encouraging students to think critically and creatively, indicating

...it is very easy to just say 'the answer is' or 'do this' and I think teachers can fall into the trap of believing that they need to be the guru of all knowledge... where knowledge, as we know, in this day and age, is moving at such a pace that you couldn't possibly keep track of all of it... and particularly in technology...

And so, in some ways, ignorance is an asset as a teacher, I think because you can say "I don't know" and let's find the answer together and also, even with stuff that you do know, if the students feel free enough to come up with, you know, to float ideas and to experiment with them, then often they come up with stuff that you would have never dreamed of because you have just found the pattern that works for you or the way that you have always done it. (Baseline Interview A, Line 31)

Graham (S2) talked about practical strategies to ensure that students' learning opportunities in food technology were maximised, stating

I've created exemplars out of [technological learning] context so that students can see what it looks like in a different context [to their own], so that they can hopefully apply it to their projects. Giving scenarios might create sparks for students. Things like historical backgrounds behind products ideas, telling how things were invented and talking about life span.

... Getting people in from outside or visiting things like Fonterra and for instance, I've got a friend coming in next week who has a book that she wrote, she's a blogger, so we're trying to include digital literacy in our programmes and keep up with the technological literacy which I think is really important when they go to the higher end [of the curriculum levels]. (Baseline Interview F, Line 161)

Helen (S1) described how she responded to feedback from her colleague, who had indicated that students were lacking the content knowledge to achieve in the senior secondary school. She stated

We just talk about eggs, and all sorts of recipes. Sometimes I make them make mayonnaise with the processor, just to show them that it happens, you know... and it's not connected to any unit... it's not really part of what they do at all. But it's experimentation and showing them what happens. And I don't know if it's improved things, but I do

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believe they know more about eggs nowadays. (Baseline Interview C, Line 237)

Mike (S1) asserted that the strategies he used were based on the premise that

Kids learn better through play. Everybody knows that playing computer games etcetera encourages learning. So you have to create a game that would encourage learning. And then we look at what makes a game addictive, and how could we make a learning game addictive. And then they go and design one, then make it. And then we put a website around their software company, and they're the software developer, and we put their game on a website, as if it could be sold and marketed. (Baseline Interview D, Line 122)

5.2.1.5 Rules of practice

The rules of practice included others' attitudes, the hidden curriculum, and the need to maintain currency within a changing technological environment. Colette (S1) most frequently referred to the rules of practice at Lakeside Academy as determined by her Head of Faculty because she felt that they were moderating her practice. She described one occasion where she had navigated a conflict in their views, stating

... I had suggested Ergonomics as the great bridging concept because everything is driven by how we fit into it or how it fits us and I was given the impression that was wrong... that was one of those moments where you go, "Oh, okay, maybe I'm not interpreting the curriculum correctly so I'll just close my mouth" or you just go "No, I disagree and I'll just go off and do it and beg forgiveness later". (Baseline Interview A, Line 211)

All other participants described the strategies that they used to manage the schools' rules of practice. Helen (S1) reflected that her adherence to the curriculum (MoE, 2007) was moderated by a need to prepare students for their potential NCEA pathway in Hospitality. She stated

I think it's become quite clear to me now, that because we don't do senior [food] technology here, I've got to bear in mind that there are certain skills that really - it's my responsibility to get through to the kids, before they start Hospitality. So I do make it my business to make sure they get as many of those skills as they can. And now that I've started [NCEA] Level One, I know what skills... the students are weakest at. (Baseline Interview C, Line 201)

The teachers' values and beliefs findings highlighted that there were a range of factors influencing their practice. These included student perceptions about the

nature of the subject as determined by their Intermediate school experiences and teachers' beliefs that the subject offered opportunities for engagement in meaningful and practical learning contexts. The effect of school-based values was also highlighted as defining the ways that the specialist areas within technology aligned with the curriculum (MoE, 2007). Teachers' objectives for the subject are discussed in the next section.

5.2.2 Objectives

Teachers' objectives for learning are likely to be affected by their perceptions about the nature of the subject, the social, cultural, political, and economic discourse in which they practice, as well as what is considered to be legitimate knowledge (Williamson, 2013). The data identified eight sub-themes, which incorporated teachers' intentions to consolidate their understanding of the technology curriculum in their school, within their specialist area, and with a view to improve their classroom based practice. They highlighted this could be done by affirming their current understandings, identifying some goals for their future practice, through the integration of curriculum knowledge, and pedagogical risk taking. Student and teacher outcomes and the need to challenge community misconceptions are discussed further in Sections 5.3.2.1 and 5.3.5.1.

All teachers made reference to their goals for student learning and the need to integrate *Technological Practice* into their practice to maintain or maximise student achievement. The concepts of teacher affirmation, teacher goals, pedagogical risk-taking, and teacher outcomes are discussed. These are introduced after the graph, which indicates the frequency of responses from each teacher, for each of the categories.

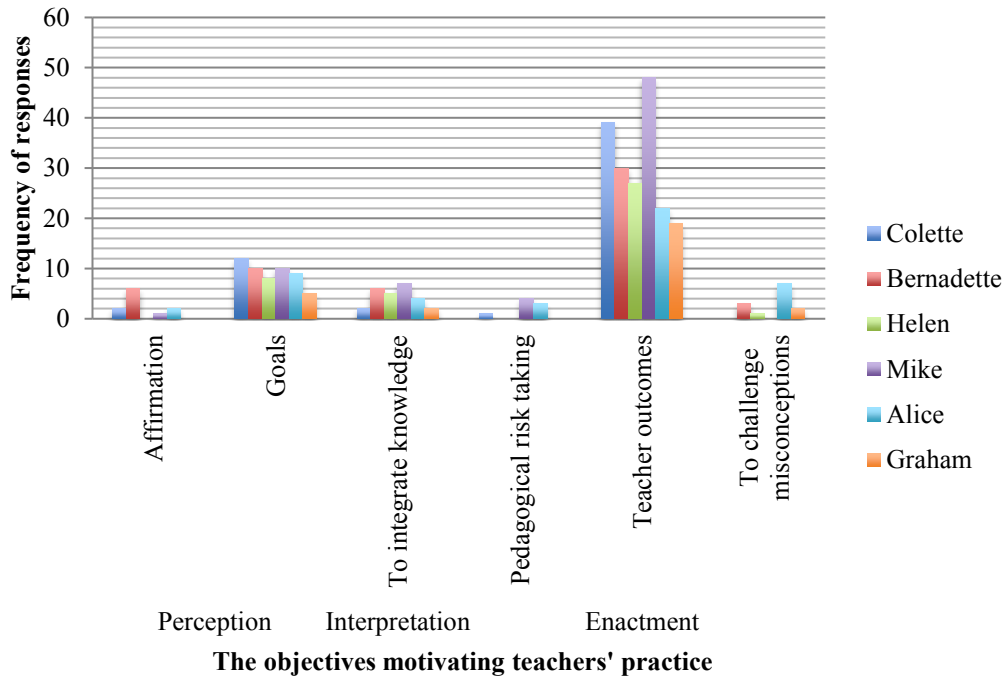


Figure 7. The objectives affecting teachers’ practice

5.2.2.1 Affirmation

Colette (S1), Mike (S1), and Alice (S2) actively sought affirmation from colleagues, including me, in relation to their professional practice. For example, Colette, Mike, and Alice indicated that they wanted to be involved in the research to gain insight into their practice and reflect upon their interpretation of the curriculum. All participants identified that it was their professional responsibility to consider how they might interpret and integrate curriculum concepts into their practice. Colette (S1) explained that because it was her first year teaching technology in New Zealand

I guess what I would like is just reassurance that my interpretation of the curriculum is not out of step. [That] what I think would be good practice and worthwhile for the students is going to be in keeping with the intent of the curriculum. [And] I think I understand what the curriculum wants from the school, it wants kids to be coming to the subject, who have got no place they fit in the school and I value and I respect that. (Baseline Interview A, Line 302)

In contrast, Bernadette sought to consolidate teachers’ understandings of the technology curriculum in her school. She was confident in her level of her understanding because of her previous experiences and stated

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... So then the Technology Curriculum came along. I guess I was one of a few teachers that picked it up and run with it. And I guess I look at it as they gave us a book with a set of rules in it, but they didn't know what the game was going to look like. And the good thing for me was that I had a chance to influence the outcome, or the direction we were going to go in.

A lot of people dropped off, and that was to their own detriment I believe... So, it was an interesting time, but when I look back on it, it was really good for me, because instead of me sitting back and saying, "Well I don't want to do that", people gave me the opportunity to say, "What do you want to do?" and, "Show us what you want to do with this thing". And that was really great. (Baseline Interview B, Line 29).

5.2.2.2 *Teacher goals*

Teachers' goals were identified as being affected by community expectations that technology education was a practical subject, as well as their professional need to foster students' technological literacy Colette described a professional tension between her personal goals, and the need to be responsive to the community's expectation when teaching technology. She stated

We want the parents to be pleased with what comes home and so if the quality of work isn't there, you know... therefore do you get projects done of a high standard based on whether the kid can cut a piece of material perfectly straight? I don't see that as being requested of them for excellence. Certainly, if they do, all the better but you know... I mean, of course, I love them to be able to cut everything straight and teach them all that...

And so [my] ideas are way out there and innovative and they push the boundaries and that's worth something where you're practical skills are subpar. Where this kid doesn't have an original thought in his head but can produce, you know, what you want them to produce... I think both of [these types of students] should be able to achieve and excel in the subject and I would like to see the subject grow and I mean, we don't have full technology classes and I think that's because the students learn very quickly that unless you are happy creating what is on offer, technology isn't for you. (Baseline Interview A, Line 353)

Mike described his goal to ensure that students' potential was maximised, through and approach to teaching that provided breadth and a range of experiences. He stated

[In the curriculum] document, they have those "may includes", "could possibly have", "might have". And they have those "will have". And I used to struggle with the "may have". And the "might". I wrote a paper on it actually, because if you took databases, it said it could be a flat one, it could be a relational one, it could be PHP (Personal Home

Page), it could be SQL (Structured Query Language). Now the range of that is huge, from a flat to an SQL. I said, “ You’ve got no common ground, you haven’t said the level”. We had a huge argument about it, about the breadth of learning, and depth, and why should we cap every kid?

I like breadth, I know it doesn’t mean you get consistency, and the kids get a different experience at every single school. (Baseline Interview D, Line 69)

5.2.2.3 Pedagogical risk taking

Interestingly, only Colette (S1), Mike (S1) and Alice (S2) referred to pedagogical risk-taking during their baseline interview. For example, Mike stated

I have tried with the Year Thirteens [with] robots, [and] prototyping. From an NZQA point of view, I’m just really scared because they did it brilliantly, right? They got [a] brief [of] a competition to enter. And it’s a real competition, so you can’t change any rules. And then I just gave them a whole box of parts, and said, “That’s what you’ve got to do”. So they did, they started making the robot and they made, tested, made, tested all the way through prototyping. Tweaking, fixing, turning - so they’ve done it. But they kind of got lost and involved in so much of the process, [and] from an NZQA point of view, collecting the evidence is difficult. (Baseline Interview D, Line 356)

Bernadette (S1), Helen (S1), Alice (S2), and Graham (S2) perceived a continued need to assure the position of the subject in the school curriculum. They felt that they were required to moderate the pedagogical risks that they were taking because of their community’s expectations about the learning that should occur when students were studying technology education. Alice stated that there were continuing tensions for technology teachers, indicating

The unsustainability of the secondary model perpetuates the content cramming philosophy. The process-orientated [approach] is really good and technology teachers are really good at teaching procedural knowledge. There have been a couple of readings lately that suggest that procedural knowledge doesn’t actually help the students. I mean, they’ve got that knowledge but it doesn’t actually really help them. It’s actually the social knowledge and the conceptual knowledge that changes the way that they think about the world. So that’s our challenge really. (Baseline Interview E, Line 147)

Graham (S2) indicated that instead of a focus on the learning in some schools there were organisational issues that determined whether senior school programmes were viable or logistically possible. He stated that in his experience

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...If you wanted to start up a new course or keep a programme running, whilst there was student interest and numbers, it might not have gone through. No matter what you say or how important you think it is to student learning or part of their schooling it's just that lack of knowledge, it's about maintaining numbers, all those things. Even just in terms of educating parents, there hasn't been that support. (Baseline Interview F, Line 34)

5.2.2.4 *Teacher outcomes*

Teacher outcomes included leadership opportunities, addressing assessment requirements, and the professional satisfaction when students' were creative. Alice described her previous experience in a leadership role, where she aimed to support teachers' understanding of the curriculum. She stated

At my last school I tried a whole lot of different things of integrating across the whole of the technology curriculum and I was fortunate there that I managed to get the Principal into thinking that we should have an overall technology co-ordinator. That wasn't as successful as I would have liked it to have been. I enjoyed that challenge because I thought that if we all worked together and we all did it, not the same way, then we actually achieve more. But that didn't quite work out...

[The plan was for] all the learning areas of technology work together and get the students, you know, to share ideas and have a common language and maybe some shared projects and bits and pieces ... That hadn't happened prior and I'd got all of the materials technology [people] on board and the food technology and then I tried to bring in the I.T. people... That actually didn't work, that destroyed what I had created. (Baseline Interview E, Line 29)

Mike's (S1) experience differed from Alice (S2). He stated that in the Digital Technology area

A lot of teachers are very committed to trying to build programmes. A lot of people do what I'm doing in Year Eleven, or they'll do a website. But a lot of them are committed into building a whole-year programme. So it's about... You take the learning, and the project, and fit the assessments around it. And a lot of the Digital people are quite committed to doing that, and trying to make that work, which is good. (Baseline Interview D, Line 165)

Colette (S1 & 2) described the professional satisfaction gained when a student engages with technology education in a critical and creative manner, stating

I mean, the teaching that I have enjoyed the most in some ways, is when you have the "academic" [student] who chooses to do technology, and then brings that wealth of knowledge that they have about physics,

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design or mathematics - they come up with some extraordinary projects.

I had student... that was a girl that had a wealth of knowledge to bring to the subject and took an interest in it. So, I don't see my subject as a place for those who can't hack academic and I think if New Zealand is going to prosper in the global economy, it's going to have to not have that stigma, if that's a truism.

I'm happy to accept that [the subject] does have to change because we need Engineers, as it were, and we need people who understand that Engineering is not just mathematics and physics but, you know, that there is a practical side to it that makes you, better. You have a tactile understanding of whatever materials you are working with. (Baseline Interview, Line 100)

The sub-themes in the objectives category highlighted that participant teachers are motivated to accommodate students' needs in technology education, whether through their engagement in professional learning or by thinking about the provision of alternative or improved pathways for learning. There were apparent tensions for Mike who felt that the subject should be taught in an iterative manner but had been constrained by the NCEA assessment framework. There also appeared to be a need for teachers to continue to justify and explain the contemporary role of technology education, in order to maintain its currency in the curriculum. The next section introduces the ways in which teachers perceived their professional roles.

5.2.3 Teacher roles

The teacher roles category consisted of five sub-themes including the teacher as learner, empowering learners, subject expertise, to address the perceived purpose of technology education. Teachers' roles and the purpose of technology education are explained further in Section 5.3.

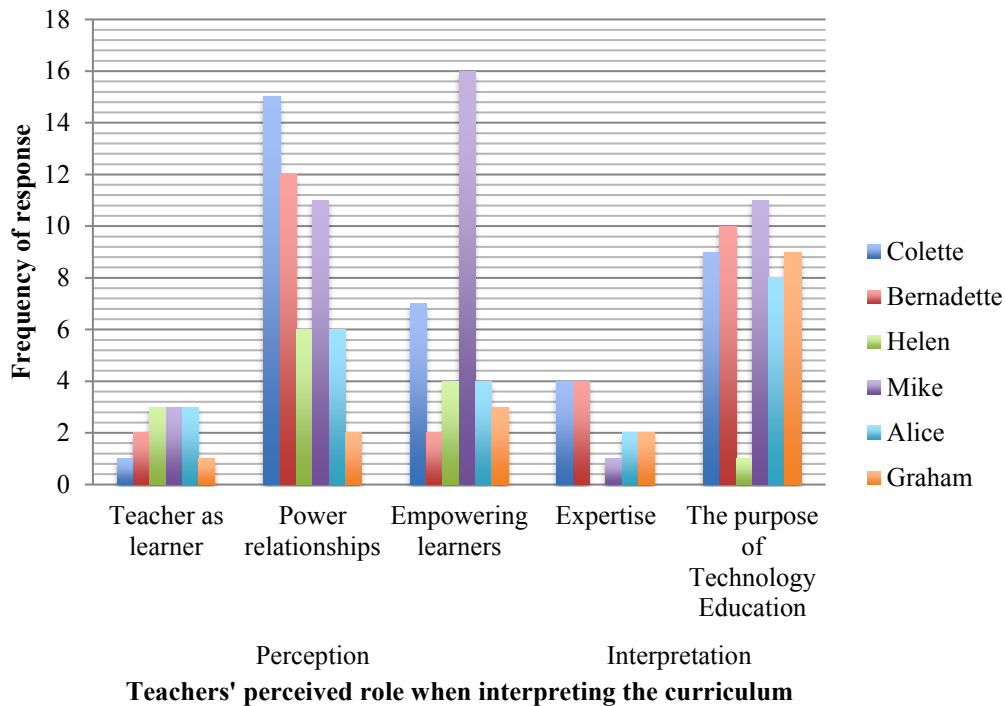


Figure 8. Teachers’ perceived role when interpreting the curriculum

Figure 8 shows that power relationships were identified regularly as affecting teacher roles. Helen (S1) did not identify a need to empower her learners or the specialist knowledge required to teach technology education, although she did refer to her engagement with professional learning. The participants’ perceived purpose of technology education is presented later, in Section 5.3. The pertinent findings related to two sub-themes, including the teacher as learner, empowering learners and expertise next.

5.2.3.1 Teacher as learner

All of the teachers acknowledged the need for them to continue to learn professionally. For example, Graham (S2) described the range of strategies he used to remain current in his practice, stating

I talk to others, Techlink is my friend, I read papers, I just draw upon all of the stuff that I’ve learnt in the past too and always reflect and think about my practice and how I can do better. I learn from students, if things are working or not working. I don’t ever do the same unit or the same project again.

To keep me engaged as well, I like to change it up and I think that students pick up on that too. I think that you have got to keep yourself actively in the know and motivated because it’s easy to sit back and just

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deliver skills and knowledge or just skills and you would get away with it because nobody else knows any different or if they do, they'll just go, it's one of those teachers that do that. No disrespect to them but that's sometimes how it works out. Which is not okay. (Baseline Interview F, Line 187)

Helen (S1) indicated a need for her to prioritise which professional learning she could engage with, stating

Professionally, well I've tried my best to get up to speed with technology [education], but it's been a bit hard because my family kind of come first. They always have. So I've done whatever I can within the school hours, like if I can take a day off to do PD, I do it. (Baseline Interview C, Line 186)

5.2.3.2 *Empowering learners*

All participants mentioned the effect of power relationships on their professional role and within the classroom. Colette (S1), Mike (S1), Alice (S2), and Graham (S2) all indicated that teachers of technology education could empower learners and be responsive to their needs, thereby changing the power dynamics between themselves and the students. For example, Mike stated

I think it's [about] allowing them to choose their own topics. It's hard work - that's really hard. I've seen other teachers who just give them "You will make..." and I don't, I say, "What would you like to make?" So they own it. And when they own it you get much better results. (Baseline Interview D, Line 107)

Helen indicated that because she was an overseas trained teacher, she had been required to reflect upon her relationships with students and classroom environment that she fostered. She stated that in her school

You've got to be fair [to the students]. I don't think it's always that fair to the teacher, but anyway, you know what I mean. As long as you're fair to them, they're pretty okay with you. I think - it took me a little while to feel accepted, in a way.

...I've found the noise level quite a problem, honestly. I think there are a few things - I don't have a very loud voice, and we're in this place that's not very acoustically easy anyway.

And the fact that they are really here, at the back of their minds, to cook - they want to cook when they walk in. (Baseline Interview C, Line, 284)

5.2.3.3 *Expertise*

Expertise was referred to as being as the result of engagement with professional development or from years of teaching the subject. Despite her extensive overseas teaching experience, Colette (S1 & 2) appeared confused about how the curriculum should be taught. She stated

It's been told to me here "We'll introduce a nature component", so that's what I'm waiting for, to be given the nature component for the 10 technology [class] and I don't know what that's going to look like.

Where I've taken it upon myself to go, from that PD, "Oh, okay, I like that and can incorporate that [worksheet] and can see the value of that in my class"... the feedback I got was that that should be for products that are already in existence, so like this [pencil sharpener].

I thought that this seemed to incorporate those questions quite adequately but I got the impression that "no, it's not in keeping with the curriculum".

I'm finding that I've got my interpretation of the curriculum but that other people have theirs and of course, being new to it all ... on the one hand you kind of go, well maybe I'm misinterpreting it and then on the other hand you go, well I've sixteen years of experience and I can read a paragraph from a curriculum as well as anybody else and derive understanding from it. (Baseline Interview A, Line 140)

Bernadette (S1) suggested that her expertise as a technology teacher was an evolving process, occurring over several years and inclusive of both the curriculum and content knowledge required in her technological area. She stated

I started with Workshop Technology, which suited me right down to the ground, because the area that I come from in my trades, and my interests those days. And being able to show kids how to spray paint, and being able to make things and play with fibreglass, all that sort of stuff. It just suited me right down to the ground.

The transition [to Technology Education] for the first couple of years was a little bit hard. But in saying that, it was really not much different from what I was doing. 'Cause my philosophy was let's make it if we can make it, let's do it. If we can design and make it let's not worry about how we're going to do it, we'll find out how to do it.

So, it was an interesting time, but when I look back on it, it was really good for me... As we've gone along, you know, we've developed the Tech. Practice side of it anyway, and we've developed the other two strands, and I guess we've got a more holistic approach to it now, than we did have at the beginning with the Design Technology side of it. But still focussing on quality outcomes and practical work and that sort of stuff as well. (Baseline Interview B, Line 12)

All participants, with the exception of Helen, acknowledged the expertise required to teach technology education. The teacher role category highlighted that practitioners acknowledged their need to be learners and maintain currency in their professional practice. There was recognition that it was their responsibility to be responsive to and empower their learners. The affect of the school’s discourse on teachers practice is introduced next.

5.2.4 Discourse

The discourse category was organised according to participants’ descriptions of how they were interpreting the curriculum for their own practice. The data were categorised into two sub-themes, comprising teachers’ meaning-making processes and written discourse.

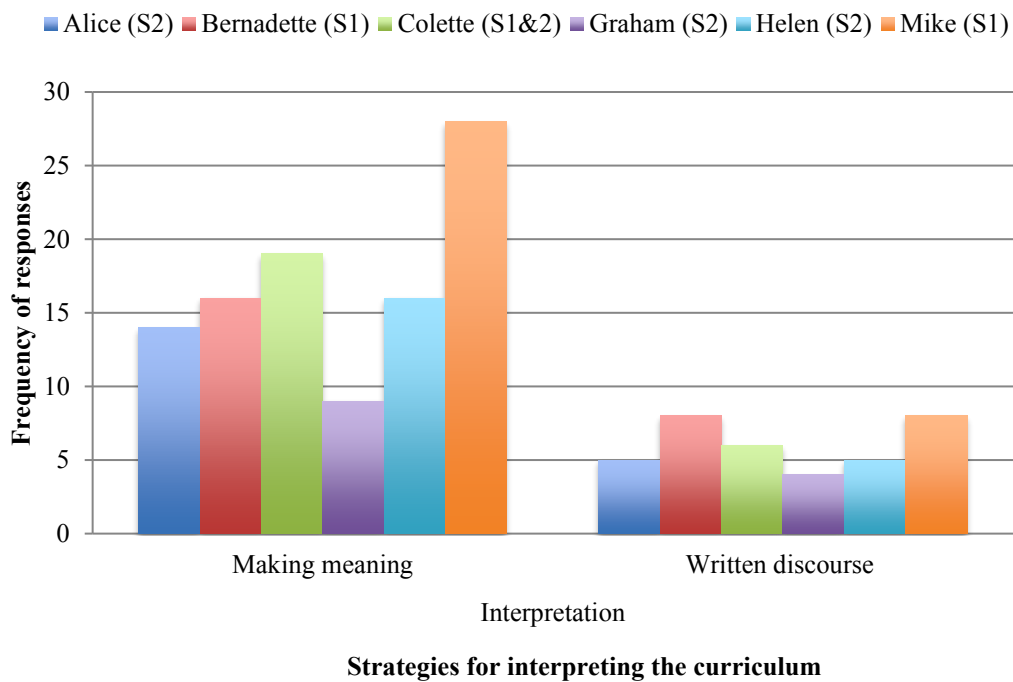


Figure 9. The strategies used to interpret the curriculum

All participants made reference to meaning making processes that were required to interpret the curriculum text and apply their understandings in practice.

5.2.4.1 Meaning-making

All participants identified the need to have some understanding of the official curriculum (MoE, 2007) for their own specialist area of technology. They

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indicated that they had made meaning of the curriculum in a variety of ways as presented in Table 10 (Reinsfield, 2017a, 2017b).

Table 10. Meaning making of the technology curriculum

Participant	Meaning making processes	Strategies
Alice (S2)	Professional Development (PD - Both school-based and external)	Collaboratively (with colleagues), by experimenting.
Bernadette (S1)	PD; Testing ideas; Generating resources; Reflecting on teaching; Making links with industry	By adapting contexts and pedagogical approaches, collaboratively (with industry and Beacon Practice colleagues), by engaging with subject specific resources.
Colette (S1&2)	Adaption of resources from school-based or national PD	By experimenting and changing provided resources.
Graham (S2)	External PD; Technology Online; Academic readings; Teaching new concepts and reflective practice	By adapting contexts and pedagogical approaches, by experimenting, and engaging with subject specific and academic resources.
Helen (S1)	PD; Replication of colleagues strategies and tasks; Developing a template to follow (R)	By replicating the practice of other technology teachers or activities based on previous teaching experience.
Mike (S1)	PD with Digital Technology teachers; Trial and error (C/E)	Collaboratively, by experimenting.

All participants identified strategies to support their understanding of the curriculum for application in their own classrooms and specialist areas of technology. Mike (S1) identified a need to gain support from digital technology colleagues in other schools and indicated

...There's a consensus of us, and I have to say I'm kind of on the fence here, I'm not terribly sure really... who think that digital [technology] needs to come out of the technology field, because we have had to shoehorn some of the things to make it fit technology [education].

Only because [of] the old way they teach it still, really.

[Technology education is] very structured. I.T.'s not structured; it's a very fluid industry. And it doesn't really have a structure because it is all about thinking outside the box. And if you output too much

structure, you can't go outside the box. (Baseline Interview D, Line 276)

During the baseline interviews, Bernadette (S1), Mike (S1), and Graham (S2) used terminology that suggested a familiarity with the intent and all three strands in the technology curriculum (MoE, 2007). Helen (S1), Colette (S1), and Alice (S2) used terminology that related to the *Technological Practice* strand of the technology curriculum - and in connection to the development of outcomes.

5.2.4.2 *Written discourse*

The category of written discourse related to teachers' discussions about the nature of the curriculum (MoE, 2007) and the way that they were interpreting it. The discourse category highlighted a lack of understanding of the contemporary nature of technology education.

The first section of this chapter identified the categories emerging from the baseline interview data, including teachers' values and beliefs, objectives, understanding of discourse, and perceived professional roles. The next section identifies each teacher's espoused perceptions and practice, and the data is based upon their interviews, reflections and lesson observations.

5.3 Perceptions to practice: Lesson observations

There was a diversity of perspectives and attitudes represented by individual teachers, with disparity in espoused perceptions and practice. Alice (S2) and Graham (S2) represented the view that learning should focus on developing student capability and in response to students' interests. They presented the impression that their practice was contemporary in nature. During their lesson however, these teachers' practice emphasised the outcomes being developed. Teachers' espoused perceptions and practices are presented in Table 11.

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Table 11. Teachers' espoused perceptions and practice

Participant	Espoused perceptions	Practice
Alice (S2)	Technology education can support learning about the nature of technology, in an integrated manner, and to focus on issues like sustainability, enterprise and empowerment	Students need to develop skills and knowledge first, to be successful in technology education.
Bernadette (S1)	Technology education can provide academic and vocational pathways for learning. To develop student capability, teachers need to expose learners to a range of different contexts	Bernadette explicitly focused on teaching the technological concepts as they are presented in the curriculum and to aid learner achievement.
Colette (S1&2)	Technology education provides opportunities to allow students to direct their own learning and be innovative in their thinking	Practice was based upon the replication of a pre-determined outcome, and teacher directed in nature.
Graham (S2)	The practical nature of the subject is a "hook" for students, to engage them in their learning. He wanted learning to be "visible" and engaging for his learners	Practice focused in the establishment of routines, rules of practice and the making of a quality outcome.
Helen (S1)	Helen expressed concerns about how food technology was perceived by the students in her school. She indicated that they only wanted to engage in practical tasks	Practice focused on classroom management and emphasised the planning for practical tasks.
Mike (S1)	Digital technology does not always align easily with technology education. There are times where students have the skills to be self-regulating but sometimes they have to be told what they are making	Practice focused on the Technological Practice strand of the curriculum. Students were designing a website based on a topic of their interest.

Whilst Helen (S1) emphasised her role in the transmission of knowledge and the development of skills, this did not manifest during her lesson. Conversely, Alice (S2), Bernadette (S1), Colette (S1) and Graham (S2) all transmitted knowledge to students but had not highlighted this as something they perceived important to their teaching of technology education. Colette's lesson focused on the stages of production for an outcome and the Trades-based assessment in a senior class.

All observed lessons were tracked against the curriculum to determine which components had been addressed and at what level. Four of the six participants

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aimed the content of their lesson to the levels of achievement recommended in the curriculum (MoE, 2007, p. 45). The exceptions to this were Alice (S2) and Colette (when she was at S1). Alice’s lesson demonstrated coverage of several components within the technology curriculum at an Emergent level of understanding, rather than Levels 2 to 5, as recommended within the New Zealand curriculum for Years 7 and 8 students (MoE, 2007, p. 45). Graham’s (S2) coverage of the curriculum was affected by the nature of his lesson, which focused on safety issues and making students comfortable in the kitchen environment. He did however, address some aspects of the *Nature of Technology* and *Technological Knowledge* strands because students’ were exposed to learning about the properties of different ingredients and skills when making food outcomes. The curriculum coverage is outlined in Table 12, organised according to the different strands and components, and levels at which the lessons were aimed.

Table 12. Tracking of curriculum coverage

Technological Practice	Brief Development	Alice (Emergent) Bernadette (Level 8) Mike (Level 4)
	Planning for Practice	Alice (Emergent) Bernadette (Level 8)
	Outcome Development and Evaluation	Alice (Emergent) Bernadette (Level 8) Colette (Level 5) Graham, Helen, & Mike (Level 4)
Nature of Technology	Characteristics of Technology	Alice (Emergent)
	Characteristics of Technological Outcomes	Alice (Emergent) Bernadette (Level 8) Graham (Level 2)
Technological Knowledge	Technological Modelling	Bernadette (Level 8) Mike (Level 4)
	Technological Products	Graham (Level 2) Helen (Level 4)
	Technological Systems	Alice (Emergent)

Bernadette (S1) and Mike (S1) demonstrated sound knowledge of the curriculum (MoE, 2007) by integrating curriculum terminology into their dialogue with students. Bernadette’s lesson demonstrated a responsive approach and a

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familiarity with the curriculum components in her specialist area of hard materials (metal). Mike was also confident with the concepts from the technology curriculum and could make connections between these and his specialist area of digital technology. This was achieved through a project, which asked students to conceptually develop a website, based on their interests.

The combination and level of curriculum coverage for each of the teachers is interesting. For example, according to Table 12, Alice (S2) appears to have addressed a variety of technological concepts, suggesting sound coverage of the curriculum (MoE, 2007). The level at which these concepts were aimed was significantly below the curriculum recommendations. Alice explained that this was because of students' lack of exposure to technology education in their previous schools, leading to some issues with students' self-regulation. She explained

With their technological practice, they were Emergent because they had no idea how to put a drill bit in, the fundamental understanding that you've got materials and you can add to them or subtract from them, they've never made anything.

So when it came to them making a movie, they were taught how to use a proper [computer] package and they managed to work their way through that and they were manipulating data and taking images and adding special effects and that was awesome.

Their products weren't bad that they made for the movies, a lot of them made knives, because knives are a great project and if you can make them legitimately, that's cool. They made a whole load of stuff on the 3-D printer... [With the] props they used the hot glue gun which is fit for purpose but that was a great project.

So on the one hand we've got Emergent students but on the other hand you've got some making great stuff. (Final Interview E, Line 424)

At Lakeside Academy there was a professional learning focus on the *Nature of Technology* strand and an expectation that the components of Characteristics of Technology (CoT) and Characteristics of Technological Outcomes (CoTO) were being emphasised in the junior school teaching. Helen's (S1) lesson demonstrated limited coverage of the curriculum however, because of an initial focus on students' work plans. The second phase of Helen's lesson planned to focus on the *Nature of Technology* strand of the curriculum (MoE, 2007). She had adapted

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resources provided by Bernadette (S1) but did not address the intended component of the curriculum (See Section 5.3.5).

Out of the eight technological components within the curriculum (MoE, 2007), all teachers covered aspects of Outcome Development and Evaluation (OD&E) in the *Technological Practice* strand. The second most frequent components being addressed were Brief Development (BD), also from the *Technological Practice* strand, and the Characteristics of Technological Outcomes (CoTO) component from the *Nature of Technology* strand. This suggested a propensity to teach content that emphasised the practical realisation of an outcome.

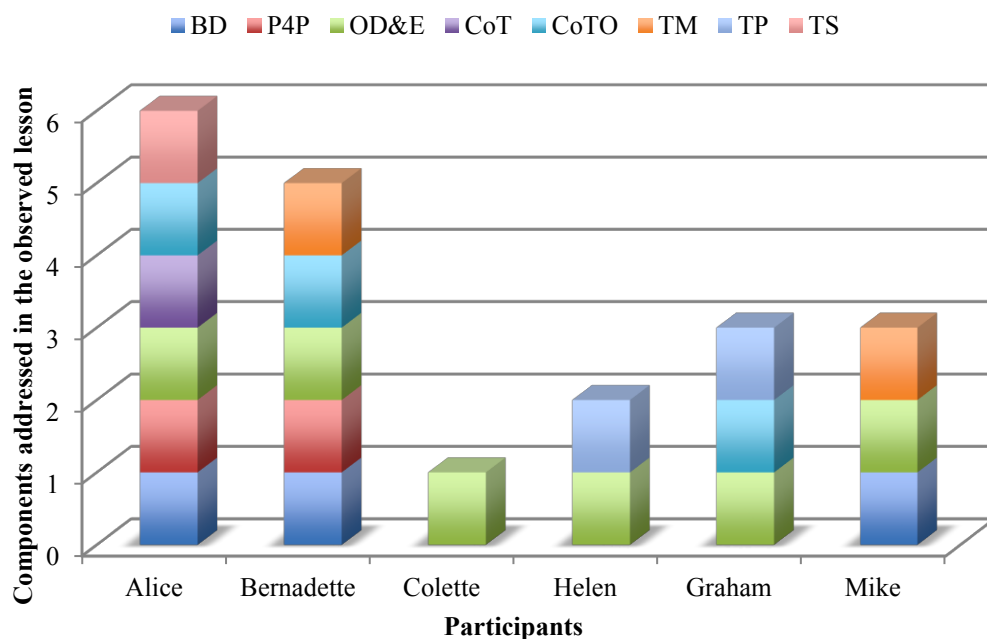


Figure 10. The coverage of curriculum concepts during the observed lessons

The coverage of curriculum concepts was connected to the pedagogical approaches and the content of focus in each teacher's classroom practice. Section 5.3.1.2 presents the factors affecting participants' practice in their classroom. Activity theory is used to review the findings. The elements of each activity system use Engeström's (1987, 2001) expanded theory of activity systems as outlined in Table 13.

Table 13. The explanatory framework

Activity system Elements	Explanation
Tools and signs	The theoretical ideas and resources available for developing understandings of technology education
Mediating artefacts	The conceptual and physical resources that represent learning processes
Subjects	Teachers of technology
Objects	Teachers' perceptions and engagement with the technology curriculum
Rules	The discourse determining the sociocultural environment
Community	Teachers of technology, school community and the influence of political agenda
Division of labour	Teachers' roles in the department, use of pedagogies
Outcomes	Representations of teachers' understanding of technology education - The purpose of the lesson.

The first part of this section presented the findings for all participants. Next, the circumstances for each of the participants (in alphabetical order) are presented to acknowledge their self-reported engagement with professional development and espoused perceptions and practice.

5.3.1 Alice (S2)

Alice identified that she had engaged in professional development through Advisory groups, Professional Associations, national conferences and the Virtual Learning Network (VLN). The VLN is an interactive resource provided by the Ministry of Education for all New Zealand educators.

5.3.1.1 Perceptions

The baseline interview indicated that Alice held strong beliefs about the purpose of education and was philosophically driven in ideology because she communicated a view that students should be exposed to learning that would support understanding of the need for a more just and equal society (Reinsfield & Williams, 2015; Schiro, 2008). She stated

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...The teachers who are doing technology say, “ We’re just going to make some stuff kids” and let’s get in there and have a good time and really [the students] don’t get a fundamental understanding of it, which is a shame. (Baseline Interview E, Line 96)

Alice felt that changing others’ perceptions about the nature of technology education was difficult because

What we’ve been trying to do is just too different to what the students are used to and other teachers are used to and so everyone had put up their own barriers.

Technology teachers have been just as bad as everyone else in putting up barriers in their thinking because you look at most teacher’s programmes and they’re not what’s best for the student but they are actually what’s easiest for them.

The teachers that like control go for the unit standards and the booklets and the teachers that like messing around with computers seem to do that and their students seem to be up the walls. (Baseline Interview E, Line 20).

Alice asserted that at Greenhill School, the technology teachers were cognisant of the assumptions made about the subject, stating

I could never understand in other schools when [students] come into the woodwork room... expected to make stuff and they didn’t make stuff in any other class...

I’ve always thought about the sub-text that I’m putting out there. I’m sure it’s there. I mean I like making stuff instead of talking about it or planning.

In short, we’ve got a genuine context, a variety of ways that students can show their learning, we don’t know what the outcomes are. People say this school is an experiment, but no, it’s based on evidence and research. (Final interview E, Line 137)

Alice asserted that teachers should not default to making things. She acknowledged however, that practical work was a student expectation and that it supported understanding of technological concepts. Alice indicated that in her school

Our focus [is] on sustainability, enterprise and empowerment and I think that has got a strong weaving of the Nature of Technology in there. We’ve [also] got the other [focus] which is innovate, design and make but really we’ve got explore how those two fit together.

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We really want to empower our students and make them understand that they have a voice in the technological process and that technology is not done to them or doesn't need to be done to them ...

So we talk about the power of technology for good and how technology is inert and it's actually our human values that make it good or bad, so that's an important thing that we are working on and linking all areas of the curriculum and finding a balance between knowledge and process.

What do we want taught in technology? We want our students to be able to solve problems and make stuff to solve those problems that makes a difference to them, to the community, to the world, and present that to an authentic audience. (Baseline Interview E, Line 187)

According to Alice, technology education has strength in its diversity. She argued for an approach that allowed students to solve problems in an authentic or real-world learning context. At Greenhill School, Alice worked with "Co-teachers" (the school's term for teachers working collaboratively together) to develop a naturally integrative curriculum. In her view, technology education could lead such a curriculum because its content can be based on values and the extension of human capability and facilitate learning about sustainability, enterprise, and empowerment.

Alice signalled some personal tension that resulted from teaching in a school where computer aided design and manufacturing equipment (CAD/CAM) was readily available and could produce an outcome overnight and without human intervention. She explained that it was still important for students to be encouraged to develop manual skills. Alice rationalised her concerns, stating that the Senior High School were

... Getting some quite technical equipment, he's getting a big laser cutter and CNC machine so we'll go down there as well and it'll be great for big projects. You might spend two terms designing something on a CAD package and then he'll press a button, go home and it'll be made in the morning and that's an okay thing but it's good to have some hand skills. (Final Interview E, Line 421)

Alice also identified that she had experienced some difficulty in accommodating both student voice and the need to make meaningful links with the curriculum (MoE, 2007). She suggested that this might be attributable to the fact that the school was still in its establishment phase. Alice indicated a need to position technology education as a subject underpinned by innovation and/or sustainable practices. She described a tension between a future-focused subject that could

make a difference to society and a traditional one, which valued an emphasis on quality outcomes to be sent home to parents.

5.3.1.2 Classroom practice

Alice’s lesson contrasted with her espoused perceptions. The lesson was with a class consisting of Year 7 to 10 students whom she described as being “Emergent” in terms of their understanding of technology education. The learning environment consisted of a large open space, shared with two other teachers who had their own groups of students. It was at times difficult for the students to hear what Alice was saying over the noise from the other groups.

The learning context was entitled a “Formula One” project and focused on the collaborative production of a car. This lesson began with teacher-led discussion (for eight minutes) about the planning processes required for the production of their Formula One car. The students then transitioned to an activity where they were required to conduct online research about electric motors. Alice’s lesson is represented as the activity system in Figure 11.

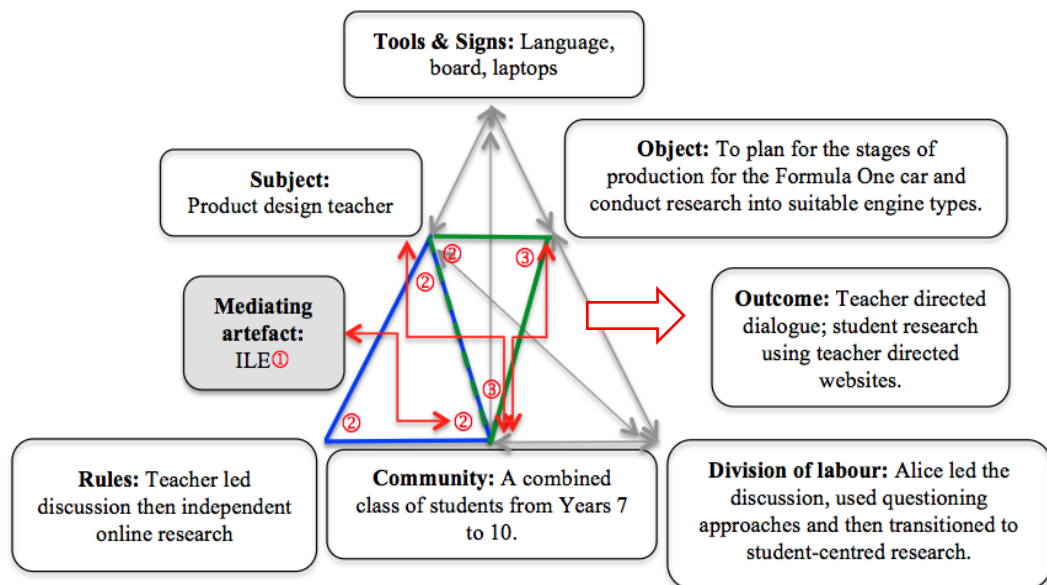


Figure 11. Activity system A

Adapted from Engeström’s third generation of activity theory (2001)

Alice’s lesson was strongly influenced by the subject-rule and subject-community objectives. She emphasised her rules and described her classroom expectations by (initially) directing students to get out their equipment. The lesson content

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focused on the making of a pre-determined practical outcome - namely a car that would be produced by the students. When introducing the lesson's focus, Alice stated

Welcome to this Formula One class, now, because we design and we make and we evaluate things, what we want to do is work efficiently and keep that design time down to a minimum. The design time that we do is really, really important. Every hour that we spend in here [the classroom] is going to save us two hours in there [the workshop]...

So, this planning time is really, really important because if we go in there and just cut up a whole load of material, and then we make our car and then we think, "oh, we've made it too short... too long... too wide, and we've not made it fast enough, then it just uses too much material and uses too much time". (Lesson Observation E, Line 7)

Alice also indicated to the class that there had been some organisational issues that had impacted on her preparation for the project, explaining

...I apologise for last week as setting this workshop up is taking an enormous amount of time because everything that we've got in there, I need to find three quotes for it, I need to get it approved, I need to get it in there, I need to get it sorted, so there's a huge amount of workload on me at the moment. (Lesson Observation E, Line 19)

As the lesson progressed, Alice discussed the components of a car with the students

Okay, so what type of engine are we using? Yep... Electric, yep, awesome, yep, excellent, yep, it's a Pick Axe Microchip, I think its based, you're talking about 5, 5 timer, is that what you were going to say? No, just Pick Axe... It's got Pick Axe in it to run the motor...

So, we could design a car that's really really fast, but it might not be the most economical, so we have to decide what's the most important. (Lesson observation E, Line 45)

In the final phase of the observed lesson, Alice changed the nature of the learning by directing students to do some independent research. She limited them to research about electric motors and provided the hyperlink to a website. She stated

Okay, you've got ten minutes and I'm going to get you to report back, and find out what you can about electric motors... Types of electric motors, fastest electric motors are good, any electric motors, okay? It could be the electric motor that's in your computer... (Lesson Observation E, line 65)

During her final interview, Alice reflected upon this lesson and indicated that she had cancelled that project. She explained

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They were some pretty difficult kids last year and I thought, “My God, have I lost my touch?” ... I thought, “Usually I can handle these kids easy”, then I forgot the process that you go through when you go to a new school and you think “Oh, I’ve been through this before”, you’ve got to do the hard yards and you’ve got to build the trust and build the relationships and in a few years time, you’ll have no problems with any kids, ... and we just got less and less done ...

I thought, it’s not working and this school is about being flexible, we don’t have to struggle to the end of the year, so I sat down and had a bit of a counselling session with the students and I asked “What’s going well, what’s not going well, how many of you guys want to continue?” They didn’t really care and I said, “Oh well, next semester, you choose something else”.

...[Next term] I just did a making class and we just did some more basic stuff, it was a different group of kids and we did some 3-D printing and we did some laser cutting and we did some basic wood materials and it was pretty much saying this is what we’ll make and this is how we’ll make it and there was flexibility, I mean after, they made something on the 3-D printer they could make whatever they like.

It’s a culture thing and its [about] building capability. We’ve had some students make some good little projects but it’s the exception rather than the rule. (Final Interview E, Line 5, 38)

Alice also described a project that she felt had been more successful. She indicated

I did a maths [and] technology module and we did a whole load of small things. We did a puzzle that’s got pins on and three circles and you’ve got to get them to the other side. It was a great project and we got the kids to work out the minimum number of moves and how many moves would be required if you had one more disc and then they worked out the formula for it, so it was fantastic. (Final interview E, Line 389)

Alice reflected upon the lesson observation during her final interview, stating

I just had so much on my mind at that point, trying to set up the workshop and having kids here and it just shows you that you can’t multi-task like that and you’re not doing the best job that you can and you’ve got to really focus on the kids in front of you. (Final Interview E, Line 94)

She also reflected that if ideas for learning are

Student generated, then they work and maybe that was the problem, I was saying, “We’re making this car”...

Yeah, they just didn’t have the skills and I wasn’t able to support them with what they needed. They didn’t come with the toolset and you are

always going to be beating your head against a brick wall with that.
(Final Interview E, Line 227)

Alice's data indicated that whilst she had established a reputation in the technology community for her work in the subject, her transition to a newly established school context had caused her some professional tension. Her perceptions aligned with the curriculum values (MoE, 2007, p. 38), and the school context advocated for learning that was future-focused in nature. The reality of managing this alongside her other responsibilities was affecting her practice. The next section describes Bernadette's data.

5.3.2 Bernadette (S1)

Bernadette did not disclose information about her previous professional development experience. She did indicate however, that she would engage in anything available if she perceived it to be beneficial to her practice. Her interest in my research was as a means to encourage departmental dialogue about the nature of technology education in their school. The baseline interview indicated that Bernadette held strong beliefs about the purpose of technology education. She stated

Well, the first thing I believe is that the students have got ownership over what they are doing. Even in the junior units, they're given a context and an issue. They've still got ownership.

[Technology education] doesn't suit every student, but neither does maths and English, okay? And we've got alternatives. We run our vocational pathway. But in general, I think [technology education] caters for 90% of the students, especially up to Level One, [where] the academic side of it starts to grow a little bit. (Baseline Interview B, Line 74)

5.3.2.1 Perceptions

Bernadette gave the impression that she was knowledge and socially-driven in ideology because she explained that the subject was academic in nature and could provide a range of vocational pathways (Reinsfield & Williams, 2015; Schiro, 2008). During the first interview, she described her perception that

...A lot of the other curriculum [areas] still don't understand Technology; don't know the breadth of it and what we can cover. So I guess it's still slightly got that stigma of it's a workshop, woodwork, metalwork type thing.

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But I think this school [is] now starting to develop a really good understanding, because of the success that we've had, and the standing that we've got. You know, nationally, and within the community... when students have gone through [technology education], not only do they learn how to make things, that is one of the parts of it, but it's got so many other aspects to it... it prepares students to go out and be citizens and to go into the workforce, and be prepared to learn, and be prepared to work with people.

I enjoy teaching the technology curriculum, and it's been good for me because it's extended my ability. It's made me think a lot more than I thought I could ever think about something. At times I sometimes surprise myself... About the way I understand it, and I see it. (Baseline Interview B, Line 125)

Bernadette felt empowered to challenge others' perceptions about the nature of the subject, explaining

I have no issues in talking to people about our subject, and telling them what it is. And putting it right... Correct them when they call it woodwork and metalwork. (Baseline Interview, Line 140)

Bernadette suggested that in the junior school

And just over the last few years I've taken an interest in the Nature strand, and I've introduced it into my junior programmes from Year Nine to Year Ten. And I'm just starting to develop an understanding of how that filters through to my senior programmes. So really, you know, the practice is there because that guides us.

But the other two strands are important as well. And if they're delivered properly, they can be really exciting. And they just give us that depth of our practice. You know, it is meaningful. I guess the more you learn about it, the more you realise you're doing it anyway. (Baseline Interview B, Line 180)

Bernadette asserted that there were some challenges when engaging with the curriculum because the *Nature of Technology* strand

[Is] really hard for people to get an understanding of... Unless you want to and you can see a reason for it, most technology teachers don't know about it and they are doing it, maybe, but they're not doing it properly, they probably don't see the importance of it, there's no doubt about it, especially the Characteristics of Technology, it's pretty out there stuff. (Final Interview B, Line 53)

Bernadette described how her understanding of the subject had evolved, explaining that for her, it was important that

When [students] take their project home, the work that's in there is theirs... all the outcomes [are at] the front. And at times we don't even

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know what the outcome is going to be. We've got an idea of the context, but the outcomes are different...

We bring in the outside community side of it. ... We look at a lot of stuff like projects. A lot of prototypes, a lot of artefacts, and that makes it interesting for the students as well. It broadens their vision of what can be done. (Baseline Interview B, Line 74)

Bernadette asserted that whilst her technology teaching was well established, her practice had not evolved significantly over the last couple of years because of her Head of Faculty responsibilities.

Conversely, Bernadette described her work in the senior secondary context where students were working in groups to develop the separate components of a car to make a functioning electric vehicle. A collaborative approach to learning is unusual at this level of secondary school study because of the challenges it presents for assessing individuals in the National Certificate of Educational Achievement. Bernadette described how she had managed the project successfully, stating

I've been working with NZQA on this for the last three months because they are really keen on how it's being taught. It's really simple, there's a project within a project, so at the beginning as a team, [students] identify what they are going to make and then divide into module[s] and each student is responsible for building a module and that goes together to build a vehicle. Nothing is allowed to be welded together that is not part of your module, everything has to be bolted together so the theory is that you have got the vehicle, it could be spread out here in the room and then within an hour it can be bolted together and you can be driving it. (Final Interview B, Line 93)

Bernadette also described how she generated ideas for her teaching in the junior secondary school and indicated that she was always thinking about what might engage her learners and address the *Nature of Technology* strand. Bernadette indicated that she had the confidence to determine how products could be made later and as the result of students' concept development. She also recognised how a well-designed programme could facilitate the integration of disciplinary knowledge. Bernadette described her Year 9 project, stating

In Year Nine at the moment, we're doing a weather station. I think within that, there's a lot of teaching. There's a lot of stuff that [students] don't know about, particularly about the manufacturing and making of it. You know, about the operation of the product itself, about what it does and what it can do. There's a bit of geography in it, there's

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a bit of maths and science in it, there's a bit of practical understanding in it. And then there's the design and manufacturing of it as well. So, I think, you know the projects have got to be able to do that. (Baseline Interview B, Line 90)

During the final interview, Bernadette reflected upon her teaching, stating

I've never been involved in that old, get your hands dirty training stuff, I can do all that but that's not what my vision is about. So ever since I've started teaching, I've always been doing different things in the workshop so it's really cool that I've got the ability to see things.

I was in Whitianga and we were in this Two Dollar shop and I saw these sunglasses and I bought six pairs and I thought that's going to be our next project at school, we're going to make sunglasses. I wasn't thinking about how I was going to make them but there is great Nature [of Technology] in sunglasses in terms of where the trends have come from and what they do and how they hang on your nose and I kind of see that, I've got the vision to see that. (Final Interview B, Line 215)

Bernadette explained that her practice had evolved significantly in the past because

I used to have a really good network of people...like Vicki [Compton] and Cliff [Harwood] and all of those guys and in the early days there was so much support and people [were] flicking ideas around and you were in that group and it just sort of happened...

Later on Vicki did another couple of research things on the Nature strand and I was lucky enough to be involved in that and to develop resources and I had the ability to talk to them, talk to other teachers and so it really moved me on very fast with the Knowledge and Nature strands and I guess I just know now about it, if that makes sense?

I must admit that I don't believe that I've made a lot of ground in the last couple of years, I probably need to turn a few things over, I need to further develop the Knowledge stuff that I was doing because that was coming on really good with the properties of materials and the Nature strand as well. It's there and it's probably there more than I think but I think I need a change as well but I guess that when you're Head of Faculty, you have so many other things that you move sideways a little bit on that. (Final Interview, Line 194)

Bernadette provided a range of teacher generated resources as evidence of the way that she interpreted and enacted the curriculum (MoE, 2007). These Year 10 resources were related to the *Nature of Technology* strand. One provided a timeline of a skateboard's development and included information about the technological advancements that occurred during the product's evolution. The second required students to recall existing knowledge to interpret images of

differing skateboards. The intent of the resource was to establish students' prior knowledge and to identify where on the timeline each skateboard would be positioned as the result of its stage of evolution. These worksheets demonstrated connections the CoT and CoTO components of the technology curriculum (MoE, 2007). The next section focuses on Bernadette's classroom practice.

5.3.2.2 Classroom practice

During the observed lesson, Bernadette demonstrated sound understanding of the curriculum concepts, used technological terminology, and expertly connected students' learning to a range of technological concepts in their personalised programmes. The lesson was teacher-directed (for the first 13 minutes) but was responsive to students' immediate needs. Bernadette's lesson was with a group of Year 13 Technology students and is represented as the activity system in Figure 12.

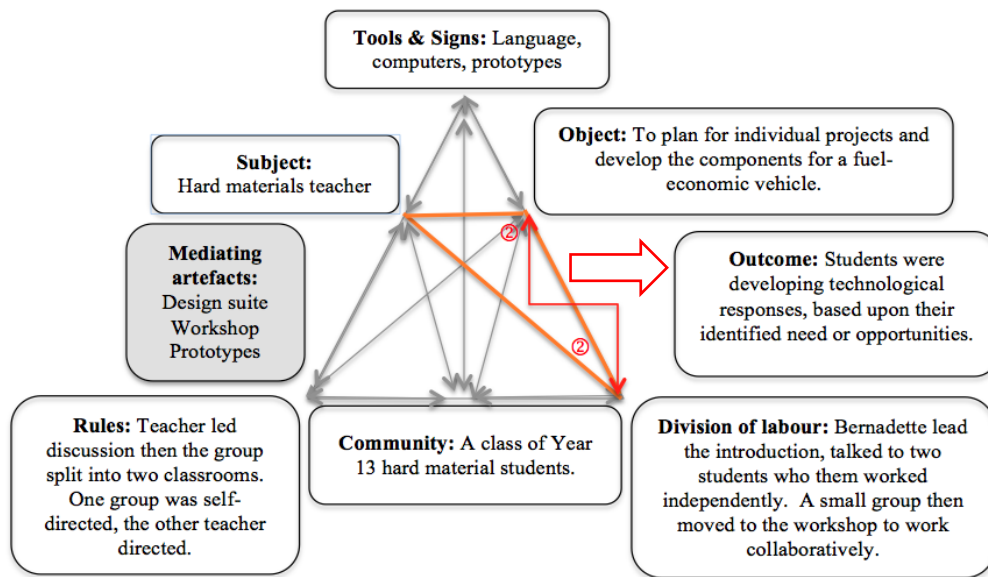


Figure 12. Activity System B

Adapted from Engeström's third generation of activity theory (2001)

During this class, Bernadette was influenced by the subject-division of labour-objective sub-activity because she was offering two pathways for learning. Both pathways were using Achievement Standards in technology education. This lesson was aimed at Level 8 of the New Zealand curriculum (MoE, 2007). One learning pathway accommodated students who wanted to work individually on the development of their own technological outcomes. The other pathway allowed

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students to work collaboratively to manufacture the components for a fuel-efficient car. This meant that she had to distribute her teaching between the differing students' needs.

Bernadette began the observed lesson with an introduction to the whole group and emphasised the need for students to record their on-going planning, stating

I guess the only thing that I'm concerned about is that we are not recording the testing that we are doing. So, between us, we are going to need to come up with an idea that can help, to record it reasonably fast. Okay, so... we are taking photographs and we are writing up those testing sheets that we've got... the i-pads are there for anyone who wants to use them.

You guys can probably tell me more about the I-pad than I know so if we're recording stuff, you know, like the other day when we had that conversation about the tail on your bike and turning things upside down, it's probably best for that to be recorded. If you want to do anything like that, the only problem is to think about how we can access that later on. We have to talk about doing a log, to just keep up with what we're doing... (Lesson Observation B, Line 1)

From there, Bernadette interacted with two students who were focusing on individual technology projects and completing design work on the classroom computers. Bernadette helped them to plan their time and negotiate how and what to discuss with their key stakeholders. A stakeholder is a term used in the technology curriculum, to describe a person or group of people who have a vested interest in a technological outcome or its development (MoE, 2007; Technology Online, 2010b). Bernadette indicated

I think it would be really good to go over there and see what [the stakeholder company] make and just see what sort of materials they make [the products] out of. Ask about sizes just so that you get an understanding of that... What about going on the afternoon of your exam, on the way home? It would be really beneficial because you could go and see what they do... they can show you, you might be able to show your concept lines, to see what he thinks... (Lesson observation B, Line 33)

Bernadette then moved to the workshop to talk to the students who were working collaboratively on the car project and described some of the rules that might constrain their technological practice. She used a prototype to illustrate her point, stating

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There's a couple of things that when I'm walking around, I'm not sure that you totally understand. This is a petrol performance vehicle, so if you're not thinking about fuel performance in anything that you do, then you're not meeting the requirements of the brief. Make sense? So, when we're doing that and when we're seeking materials, the first thing that I'll be looking at is availability of materials, okay?

To get the maximum performance out of the vehicle, it's got to be light, hasn't it? So we've got to decrease the amount of material we are using and decrease the size for the weight of the material. If we are going to do that, it will be fit for purpose. So this is fitness for purpose in the broader sense, this is exactly what we are talking about. So that's the first thing. The second thing is the aesthetic stuff, which is what it looks like.

The subjective stuff is really what we think. It's what people see... So, it's peoples' opinion of what looks good. Why don't they make cross bikes out of square section? It looks horrible ey? So people wouldn't buy it.

So when you are settling on your materials, you need to make sure that they enhance the project. So, when you are selecting your materials, it's for fuel economy and then it's for the appearance of it because as I said, the vehicles have to look really cool when they're finished. (Lesson Observation B, Line 55)

Bernadette felt that her previous professional learning experiences had positioned her well to teach technology education in a manner that allowed students with the autonomy to develop personalised products. During the lesson Bernadette demonstrated her ability to communicate her curriculum knowledge to students in a contextually appropriate, timely and relevant manner. The next section presents Colette's data, from both school contexts.

5.3.3 Colette (S1 & 2)

It was Colette's first year of teaching in the New Zealand context and she had not been involved in any professional learning that she felt might assist her understanding of the curriculum when she was first interviewed at Lakeside Academy. Colette did not believe that this was significant because she had been a teacher for over 16 years and had interpreted various curriculum documents overseas.

5.3.3.1 Perceptions

Colette alluded to a learner-centred and philosophical ideology because she described a teaching approach that valued students' interests and the role of

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technology in society (Reinsfield & Williams, 2015; Schiro, 2008). She acknowledged the rapid rate of technological change and managed this in her classroom by asserting a lack of knowledge. She felt that by doing so, this approach motivated students to become increasingly self-directed and critical about what they were learning. Colette argued that this attitude was in keeping with the philosophy of the New Zealand curriculum (MoE, 2007), stating

I guess my personal philosophy of education, regardless of the subject is that I see my job as to make myself obsolete and the sooner that I am no longer needed, the better I've done my job. So if a student no longer needs me and they have stripped me as a person of what I have to offer whether that is emotionally or mentally, or they are ready to enter the adult world, then I've completed my role in that sense.

... To have the opportunity for these students to make stuff and push things and fail, as it were, have things fall over and just go, okay, so what did you learn from that? Which is my interpretation of the curriculum.

...Everything [can] look right and ticks all the little boxes but it's not innovative and the kid is just a robot in the sense that they go over and they drill that hole there because that's where they are supposed to drill that hole and they haven't thought "Well what happens if I drill that there?" (Baseline interview A, Line 310)

Colette also argued that from her perspective

The discrepancy probably lies in what people perceive makes for good education and that is a product that people can see that looks good and is done on time and all that, as opposed to the things that are harder to measure, which is what a student learnt.

I think that we'll always have a certain level of difficulty with it, even in the mind-set of individual teachers or the parent body. You know, if the parent body has grown up with "We all built project A, they all looked like this" it's easier to measure. Where, I think with the curriculum as it is, it is harder to measure and measure everybody. (Baseline Interview A, Line 68)

She explained

I think the reason that [technology education] did have this big shake up and create a new curriculum was because it wanted things that were out of the box, it wanted students to invent stuff that the world hasn't seen or at least show the potential of doing that so that they can go to a University and produce things that the world has never seen and then create an industry, all being well, for New Zealand to produce stuff... that we sort of corner the market on, that we own the patent of and therefore we have the industry now that creates this new technology.

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That would be, I guess probably, my interpretation of the broader purpose from a government point of view and a national point of view. (Baseline Interview A, Line 415)

Colette also argued that there were implications on the way that the curriculum was interpreted because

[Some] technology teachers... they're tradesmen who become teachers and they're quite good at the trade... in other words, a tradesman at the end of the day is not paid to be innovative or creative, he is paid to produce something and get it done and have the quality.

Do it and do it right and have it be beautiful... and so its probably part of them feeling safe in doing what they've always done which is "I'm going to work, I fix this thing, I made this thing and at the end of the day, it got passed as a quality product and then when they get in the classroom, it's what they do... (Final Interview A, Line 215)

She acknowledged personal difficulty interpreting some of the New Zealand based curriculum support materials (MoE, 2010), because they

Seemed so beyond the reality of the classroom or were so specific to a particular subset of technology...[For] the nature strand, it said examples would be talking about stem cell research... and I thought, [I'm] teaching in a hard materials classroom, how am I going to make the leap from stem cell research to what we are actually doing in the workshop?

...There is plenty of stuff that is actually immediately, contextually relevant to what you are going to do in a workshop and I thought that there is no way that I am going to try to go from stem cell research to we're going to bend this piece of aluminium and how should we do that? (Baseline Interview A, Line 280)

At the beginning of the data collection phase, Colette expressed concerns about her colleagues' interpretation of the curriculum (at Lakeside Academy), stating

...Our department understands [the curriculum] conceptually but in practice, it's still "Let's produce an end product" that looks good and ticks all the little boxes, so I do find that difficult at times. I appreciate what the curriculum offers but... I think it's believed to be [taught] but it isn't really, you know what I mean? Like, you can believe that you are doing it but you're not. (Baseline Interview A, Line 59)

She described some tension between this practice and her own philosophy, explaining that

I'm not as concerned about pumping out pretty projects or the cookie cut, where they are all the same, they are all safe and they all work, but

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I appreciate that not everybody is interpreting the curriculum like that.
(Baseline Interview A, Line 46)

Colette asserted that the curriculum (MoE, 2007) provided flexibility in terms of the learning context but without the autonomy to interpret it for her own specialist area or cohort of students, it could constrain professional practice. She stated

If you don't have the freedom to implement the curriculum then you're going to just do the cookie cut thing of do what you're told. I find it difficult because I don't really feel that I have the freedom to go the direction I want to.

I think the mind-set is that [classes] should be in the same page and although I agree on that, on a level, I don't know if the intent of the curriculum document is that your classroom looks identical to mine or your projects are all the same as my projects and that what you teach week two is the same as what I teach week two... So you have personal dynamics that you have to address and deal with. (Baseline Interview A, Line 174)

It was Colette's view that technology education had the potential to empower learners and that the New Zealand curriculum (MoE, 2007) provided teachers with the flexibility and autonomy to interpret its content to enable a learner-centred classroom environment. She described her observations of the local technology education community, stating

There's one school that teaches technology, they turn out brilliant projects, they look good, they're functional, they're fit for purpose, they tick all of the boxes, but every kid makes exactly the same thing and there is no deviation except for some cutesy little thing and the end.

You're competing with a whole bunch of people whose philosophical approach is if that leaves this classroom, I'm going to look like a bad teacher, so I'm not going to teach anyone who

- a) Is going to make me look bad, and
- b) Is not going to let me make their project successful.

(Final Interview A, Line 105)

Colette acknowledged that a focus on the development of a quality outcome might be necessary for some senior secondary pathways - such as in the Trades. She asserted however, that there needed to be different pedagogical approaches for the junior secondary school setting - to empower students to take risks in their learning and to develop skills in creative and critical thinking. She explained that when students were following a pre-defined manufacturing process in technology,

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they were less likely to think creatively or make independent decisions that informed the development of their products. Colette shared the worksheet in Figure 13, as a means to illustrate how this could occur.

The worksheet is titled "Function [What it does / how it works]" and contains the following questions:

- What is the product? Who was it designed for? Is it obvious what it is? How?
- How many parts are there? Are the materials man-made?
- What is it for? How could it work better? What are the negatives in the design?
- Can you see the name of the manufacturer? Why do you think it is made from these materials?
- Would you use it? Are the materials natural? How many materials have been used? Why?
- Does it open? Does it have safety in mind? How do the parts fit together?
- What are the positives in the design? Why was it designed this way?
- Can you see the name of the manufacturer? Can you see a recycling symbol?
- What does it do? How well is it made? Does it fit together well? When is it used?
- What does each part do? What are the fastenings and how effective are they?
- What materials is it made of? What size is it? Why is it this size? What information does it tell us about the product?
- Is there a part that could break easily? How does it work? How would you hold it?
- How have the materials been shaped? How is it joined? What would you change?

Figure 13. Colette's adapted worksheet

Colette developed the worksheet above after being introduced to a similar document during professional development (PD) (See Section 5.4.1). During the PD, the original worksheet was described as being a means to assist students' understanding of the *Nature of Technology* strand of the curriculum (MoE, 2007). It had been used whilst students were looking at artefacts and with a view to develop their literacy. The original worksheet was designed to encourage students to use language, ask questions, and develop their communication skills during a product analysis task. Colette described how, as a result of this PD, she felt motivated to

Take it upon myself to go, "Oh, okay, I like that and can incorporate that and can see the value of that in my class" so... I gave that to the students after they completed their project, which [stated] "you need to hold something". They created the brief from that and their attributes. Most of them did phone holders and cases but some took it to different levels... some were great and some weren't and so I had the students sit down and I gave them two questions:

One - How could you make it better? I told them to start with that question, I think it's the fourth one down on the first column, and the "What would you change?" at the bottom of the second column there. I said "Those two, you must do" and then I said "Can you please pick

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four from each other column to assess for yourself and to assess your partner's product". (Baseline Interview A, Line 141)

During her final interview, she stated

The biggest "A-ha moment" I had was when we were unpacking the curriculum [at Greenhill School] and when I was first handed the document and they said "this is the New Zealand curriculum here you go"...

You've got this thing that folds out, and the reason that its laid out that way is because the intent of the New Zealand curriculum [is] that whether you are teaching Technology or English, at whatever level you are at, you would see all of the curriculum [as] connected.

...So the idea that what they are learning in Science should have an impact on what they are learning in Technology and what they're learning in Technology should impact their English is not only the intent of the curriculum but it is even in the way that they printed the booklet, it was designed to make you do that. (Final Interview A, Line 659)

5.3.3.2 Classroom practice

Colette appeared to understand the intent of the curriculum, but the observed lesson did not reflect this. She communicated, on various occasions during the research, the rules defining her enactment at Lakeside Academy. The observed lesson aimed to support learning within a Trade's pathway. There were limited links made to the curriculum (MoE, 2007) and an emphasis on practical skills. Colette's observed lesson was in July, just before the students started their mock examinations. The students were all making occasional tables and being assessed for two unit standards. Unit standards are competency based and students are assessed on an Achieved or Not Achieved basis (NZQA, 2017). The criteria for assessment are outlined in Table 14.

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Table 14. The assessment focus for Colette’s class

Unit standard	Title	Assessment criteria
US24352 NCEA Level 1 2 credits	Demonstrate knowledge of and apply safe work practices in the construction of a Building Construction Allied Trades (BCATS) project	<i>Students need to</i> <ul style="list-style-type: none"> • Demonstrate knowledge of safe working practices for the construction of a BCATS project • Select, maintain and use personal protective equipment (PPE) during the construction of a BCATS project.
US24356 NCEA Level 1 8 credits	Apply elementary workshop procedures and processes for a BCATS project	<i>Students need to</i> <ul style="list-style-type: none"> • Establish job requirements for a specified BCATS project • Mark out materials for further processing • Apply cutting and shaping processes • Join materials and assemble components for a BCATS project • Apply finishing processes • Complete work operations (including safe and clean work practices) • During all stages of production there needs to be the correct selection and use of tools according to the working drawings, job specifications, manufacturers instructions and workplace practice.

During her first interview, Colette described the students in her class, stating

I’ve got the Year 12’s building tables and I’ve given them a basic table to make and I’ve said to them you can change the legs and these kids are not the most dedicated but they’ve all got tables... I’ve got to hose them down, they are so on fire because they own what they are making, it’s their project, you know and some of them could be better and they’re all one table, you know and they’re all keen and they’re all excited. (Baseline Interview A, Line 370)

She reflected in her final interview that

...They weren’t expected to do anything, the expectation was just keep them from killing each other and if they get credits, good for them. They were asking me “Why are you bothering with us?” or they’d go

“We work for you” and I asked why and they said, “Well you actually try to teach us, you actually expect us to work”... (Final Interview A, Line 10)

Colette began the observed lesson by providing instructions about the relevant manufacturing stages for the production of a table and there was an emphasis on the quality indicators for a successful outcome. Colette’s lesson is analysed in Figure 14.

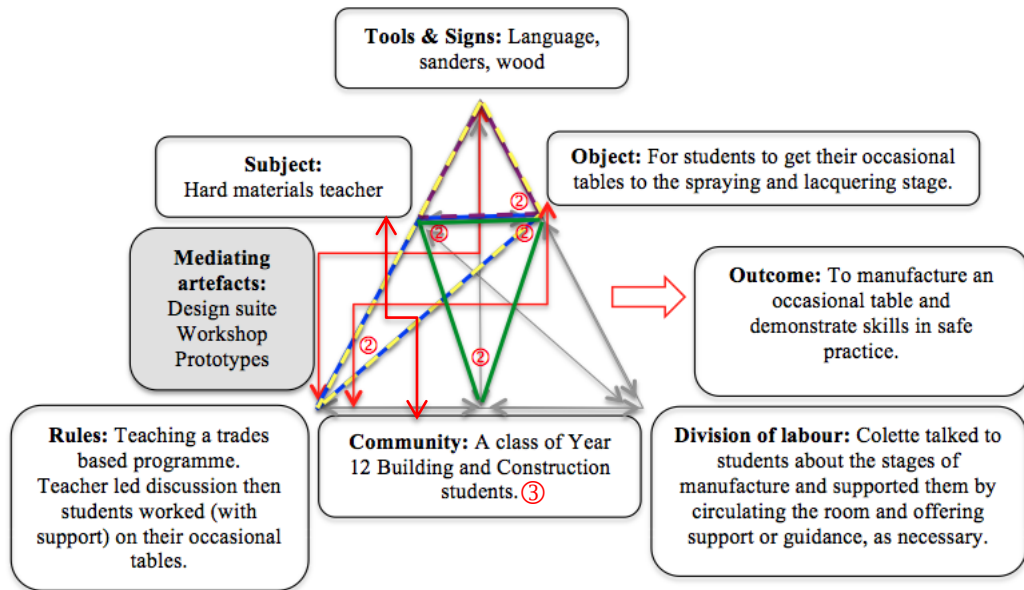


Figure 14. Activity system C

Adapted from Engeström’s third generation of activity theory (2001)

Colette’s lesson emphasised subject-rule, subject-tools and sign, rules-tool and sign, and subject-community-objectives because her focus was determined by the nature of the Trades programme being offered. The lesson focused on safe practices and three stages of production for the occasional table. Students’ activity including shaping, joining, and assembling the components that they had made and the lesson was tracked against Level 5 of the technology curriculum (MoE, 2007), which is a level lower than usual for this year group. The introduction began with the group gathering around a workbench. One student immediately expressed concerns about the quality of his outcome, and Colette indicated to him

...No, it’s all right. That’s fixable... it’s not a big issue, okay? Trust me, if I were to take it and break it into a thousand pieces then you should probably then say, “But miss, I don’t like it”...

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Okay, so some of you guys are at this stage - listen carefully please. Make sure that you get this glued up today. So if you've got just two legs, okay, remember that we glue them up, two and two, you don't do it the other way or any other combination thereof, okay... Now if you've got your legs glued up, you see there's a little step there? What are we going to do about that?

... Shave it down, okay... Then if you've got legs altogether, we need to mark out how far you are going to be coming, for our holes...

... 40? Yes. So we are going to drill the holes?

(Clicks her fingers to get students' attention, standing behind her)...

... Okay? Now, you're on to your tops and you need to get them screwed down, put the whole thing over, make sure the good side is down, mark it in and it should be about 30 'mil' [mm] in all the way around, yep? Good, screw it down, okay, and then you need to sand. If you want to "route" your edge, you need to make sure...

(Interruption)

Okay... Flip it upside down, screw it down, make sure that you pick screws that aren't so long that you screw it to the bench because that will not be a happy time...(General laughter)...Once you've got it screwed down and not screwed to the bench, if you want to route the edges remember that you have to sand those edges so that they are all flush, you don't want any bumps in the top...

Now... (Clicks her fingers and shushes the students) if you're up to the same stage as Jennifer, you're up to like 20 and you've got the top on and you've got the edge routed, okay?

Black paper now... And you are going to take your time and do it properly... I want to be able to demo. on Friday on how we are going to spray lacquer these. Understood?

What are you being assessed on?

So, if you are doing stuff with machines, what should I see?

Okay, go for it. (Lesson Observation A, Line 3)

During the lesson, Colette stood on top of one of the student's occasional tables. This caused general excitement in the classroom. When asked about her motivation for doing this, Colette stated

I stood on the table because the kids thought this thing won't work, and they're just making firewood and it won't hold a cup of tea essentially. That was the vibe that was going, we're used to failure, we're used to things not working. So when the kid got the first table together...

Liz: So she was the first?

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Yeah, the first table that was essentially to the point that it was a table and you could put something on it. And you had all of these kids sitting there [asking] is this ever going to work? Are we ever going to get there? Is it going to actually be fit for purpose?

I've had that experience before where kids have built things and they don't believe that they'll work. So I jumped up on [the table] to say, if it'll hold me, it'd hold a cup of tea. So as far as coming back to technology, it's fit for purpose, it will do what its designed to do.

It was that shock and wow factor... wanting them to embrace it and then to be able to celebrate and see that it works and shake her hand and say you've made something and hope to generate that energy in the class that says this is successful. (Final interview A, Line 514)

Toward the end of the lesson, students were told to tidy up and Colette concluded

...What I'd like to be able to do is I want to be able to get these tables sprayed. Now when we spray them guys, listen, you're going to have to do paperwork. We'll get that bookwork done, assuming that we get that bookwork done, and nobody does anything that they shouldn't be doing, you guys have already got 10 credits. (Lesson Observation A, Line 65)

In the final interview, I asked Colette what she might have done differently, to align with some of the technological concepts from the curriculum (MoE, 2007). She stated

We were obviously doing unit standard paperwork but we could easily have covered brief development and we could have easily talked about stakeholders and we could have covered all that stuff. (Final Interview, Line 262)

Colette also reflected on other constraints for her practice at Lakeside Academy, suggesting that Bernadette

Hates wood and doesn't understand it, so views it as a second grade material and so the workshop was for people who have no technological skill whatever. (Final Interview A, Line 275)

Colette suggested that at Lakeside Academy students were being directed towards pathways in the Trades if they were

...Not readily compliant, so my understanding was in the lower years where everybody has to do tech., there's a weeding out process of the ones who are not compliant, so they don't do what you tell them to and they are not necessarily bright.

Liz: As defined by?

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By the teacher in charge at the time and so then the cream is skimmed off for technology and then anybody else is encouraged to go elsewhere and [wood] is one of the places. (Final Interview A, Line 86)

Colette acknowledged that she was new to the country and was familiarising herself with the nature of technology education in relation to both the curriculum (MoE, 2007) and the local community's expectations. She recognised that the discourse at Lakeside Academy did not suit her view of education, particularly because she felt that her technological area was being marginalised. Colette suggested that the students in the class that I observed could have been provided with the opportunity to gain Achievement Standard credits alongside the Unit Standards of focus. Her practice during the observed lesson was disparate to her espoused perceptions of the purpose of technology education, that the subject had the potential to provide learning opportunities to foster students' innovative, creative, and critical thinking. The next section presents Graham's perceptions and practice.

5.3.4 Graham (S2)

Graham explained that since graduating five years ago, he had attended professional development for NCEA and junior assessment processes. He had a reputation in the local technology community as having a sound understanding of the curriculum concepts (MoE, 2007) and knowledge of the ways that food technology could be implemented at intermediate and secondary school level.

5.3.4.1 Perceptions

Graham aligned with a socially driven and learner-centred ideology (Reinsfield & Williams, 2015; Schiro, 2008). He acknowledged that the practical nature of the subject was something that could "hook" students into their learning and be responsive to their interests. According to Graham, the practical nature of the subject could be used as a default for those technology teachers whose practice had not developed to reflect the changes in the curriculum (MoE, 2007). He asserted that because of the subject's continuing associations with its technical roots, no one challenged those teachers' practice.

Graham's pedagogical interest was in "Developing rich learning experiences, with Co-teachers", by asking "Is this learning visible and engaging for our learners?" (Reflections F, Line 9). Graham indicated that to facilitate such an approach, there

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needed to be clear communication, the generation of learner evidence and the negotiation of learning opportunities with students. He valued clear communication and the relational nature of teaching. Graham articulated

I personally believe that innovation and sustainability, all the things that we talk about in the Nature [of Technology] strand, and all of the strands are all very important in how we structure our teaching and the students' learning. (Baseline Interview F, Line 75)

During his initial interview, Graham specifically talked about the pertinence of the *Nature of Technology* strand of the curriculum (MoE, 2007), asserting that there was

... Definitely a place for it. I feel like it's a strand that has been left behind and I think its due to lack of understanding, [and] knowledge. You often go to these workshops [that] have been offered in terms of NCEA - the focus is a lot on brief development and that's where students are mostly taking the Achievement Standards. I don't think I've been to one on the Nature strand and unless you do a lot of the work yourself, or you do a lot of the research, like for instance go on Techlink [Technology Online] or read papers and things like that, you don't have the understanding and you don't really know what to do, so you leave it behind. (Baseline Interview F, Line 45)

Graham advocated for a curriculum structure where coverage of the technological concepts was naturally occurring, dependent upon the learning context, and responsive to student interest. He felt that during his five years of teaching, his practice had been affected because

...Senior leadership in the past has perhaps not had the knowledge of the curriculum so it becomes very challenging to deliver a programme that you might like to deliver and so I find that it's really hard...

While I want to teach everything, like the strands in the curriculum, which I think derives instructions for the teaching and the learning, you don't always feel like you are covering as much as you would like to. (Baseline Interview F, Line 22)

He also indicated that there were historical and organisational influences, suggesting

...A lot of teachers feel comfortable in Tech. Practice, when you haven't got a lot of time. For example, the school I've just come from, we have 15 lessons to deliver a Year 7 programme and then again in Year 8 so students have 30 lessons [of food technology] in their middle schooling.

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It's really hard to incorporate everything and I have to say I'm guilty of it ... the Practice strand is the most desirable and the one that the kids love to do and so you default to that. I feel that it's key to developing a good quality outcome so you need to have the Nature strand there for students to understand, past and future trends. (Baseline Interview F, line 57)

He suggested that in his experience some teachers continued to sustain outdated practices, indicating

You hear about it and you see it and when I've worked in other schools, teachers don't look at the technology curriculum, they make stuff. It's easy to, no-one's watching you. They say, "Oh, you're doing a great job"... Here [at Greenhill School], you're looking at the curriculum in depth, you're seeing how other people are integrating it, so it's a really rich learning programme and you've got longer to do it too. (Final interview F, Line 228)

Graham shared resources through a Google document prior to my lesson observation. A series of worksheets were provided, some of which are illustrated in Figures 15 and 16.

What's the difference?

Independent activity.

Purpose: To gain an understanding of how food trends change over time.
Using the internet, find a photo of a child's lunchbox from the years below. Once you have your images, discuss what differences or similarities you notice about the lunch boxes.

1950's, way back, then...	1980's, then	2016, now
Lunch food	Lunch food	Lunch food

Explain what you notice? What is the same? Different? Why?

Figure 15. Worksheet to focus learning on the food trends in lunch boxes

The same but different?



 <ul style="list-style-type: none"> • 1 cup dried apricots • ¾ cup oats • ¼ cup desiccated coconut • 1 ½ tablespoons of coconut oil 	<p style="color: red; margin: 0;">Anzac biscuit</p>  <ul style="list-style-type: none"> • 1 cup flour • 1 cup caster sugar • 1 cup desiccated coconut • 2 cups rolled oats • 125g butter • 2 tbsp golden syrup • 1 tsp baking soda • 3 tbsp boiling water
<p>Smell, look, taste, texture.</p> <p>List the differences you see between the two products.</p>	

Figure 16. Worksheet to analyse two biscuits

The two worksheets illustrated in Figures 15 and 16 were developed by Graham as a means to engage the students who were not working directly with him during the lesson observation. Figure 15 intended to focus students' attention on food trends - specifically the development of the packed lunch box. Figure 16 provided a template to support students' analysis of existing products. Graham asserted that whilst learning should be negotiated, there were times where there should also be a focus on establishing students' understanding of both skills and routine. This lesson observation was at the start of a school year and Graham felt it was important to support students who were experiencing food technology for the first time. He suggested that for some students the practical nature of the subject could be frightening.

5.3.4.2 Classroom practice

Graham's observed lesson was deliberately designed to focus on the establishment of routines, rules of practice and the making of a quality outcome. It was teacher centred and contrasted with his previously articulated perception of the nature of technology education. Graham explained that the lesson was intended to develop students' understanding of safety in the kitchen and that the making of a quality product was a means to communicate his high expectations in this environment.

During the lesson observation, Graham organised 70 students and four Co-teachers. The Year 7 and 8 students were split into two groups. Graham had

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planned to use the Bring Your Own Device (BYOD) model for learning but the Internet was offline and he had to improvise. The BYOD model is an educational initiative used in New Zealand schools as a means to develop students' digital literacy. Students can use their own devices to engage with learning and access a range of online resources (Lee & Levins, 2012).

Graham had explained to me before the lesson that it was a 100-minute block and that students would be working in the kitchen for the second time in this school. Students were making Apricot and Oat Bliss Balls with three teachers to support them, including Graham. The other half of the cohort was in an adjacent classroom, researching food trends and conducting a sensory evaluation to compare the characteristics of Bliss Balls and Anzac biscuits. Sensory evaluation analyses human responses to food products. In food technology it encourages students to evaluate existing or developed products with a view to test, experiment and assess their fitness for purpose. The learning focus of this lesson was derived from the concept of "Food Stories". The activity system below analyses Graham's lesson and identifies the influence of the rules-tools and signs-objective sub-activity. The contradictions equated to the nature of the innovative learning environment, the skills focus of the lesson, and how the learning related to the curriculum concepts (MoE, 2007).

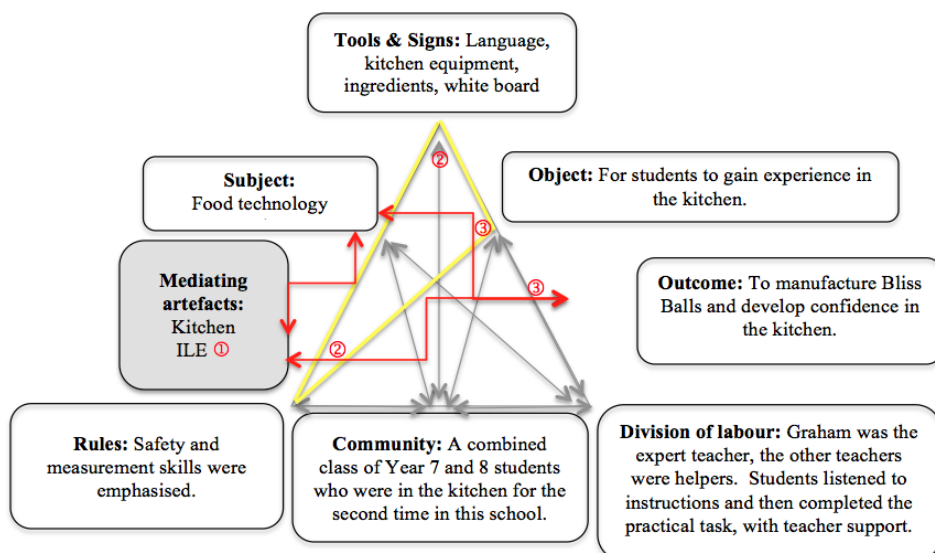


Figure 17. Activity system D

Adapted from Engeström's third generation of activity theory (2001)

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This lesson was tracked against Level 4 of the curriculum (MoE, 2007). Graham asked students about

Covered shoes, you've got your shoes? Good one... then you are going to walk calmly into the Food room, pop on your apron. Get your hat. Do you remember your number?

...Okay, we're going well, cool. You guys wash your hands. Anyone who hasn't washed their hands, you wash your hands soon. Just wait for me patiently over there...

We're not going to use the ovens today. We're going to be using just the bench tops, okay? We're going to be looking at a few different skills. One, if you look up at the board, it's to use a blender. Who's used a food processor before? More than I thought! Who finds it tricky to use a food processor? Me too. They're all different. I was stoked [happy] when I bought these, they're very user friendly, okay? And so, I'll demonstrate in a moment, how to use that... (Lesson observation F, Line 6)

Some teacher-led discussion ensued where Graham linked the previous lesson's learning with the current focus, stating

I was so impressed with your brioche last time we made it. Can anyone tell me why we made that? Why did I show you how to make brioche and then you went and made your own little brioche?

(Repeats student answer) It was my food story, it was...I used to sell them in a Café...for \$5.50 - you remember the price, okay.

(Repeats student answer) Yes... I made them up, what did I make up? ... Good - the dough existed back in the day and then I re-invented the shapes when I was a Chef. Thank you, I was hoping that you would remember that.

So that was the start of my Food Story that I'm going to share with you and there was really another reason that I got you to make that. Can anyone think of what that might be? I'll give you a hint; it was our first time in the food room...

Because it was nice, yep... That's very true.

Easy to make, that's a very nice compliment and it was easy to make. Coming into the food room for the first time can be a bit daunting, did you guys feel like that or how did you feel?

(Looks around the group).

Okay, so I got you to make something that was manageable and something to start thinking about our Food Stories and something that you can enjoy and take away as well, did you go home and tell your parents about it? Did you remember the name, brioche? That's good.

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All right, and I promise that I will get that recipe to you so that you can make it at home for your parents. You might even make up your own design and why not tell your Food Story. (Lesson observation F, Line 38)

Graham next demonstrated how to measure apricots, emphasising his expectations

...When you put in your apricots, it must be packed in to the cup, it's just flat but it's packed. That's one cup of apricots, so that's a cup measurement. You have to read the measurements on the cup to make sure that you are going to have an accurate amount because you are right, if you don't have the right amount of anything, it'll look different to other peoples and it might not bind. All right? Do you know what bind means? Yep, stick together, in this case. Bliss balls are compact and they should stick together when moulding it in your hands. (Lesson Observation F, Line 94)

During his final interview, Graham was asked to describe how the project had evolved after the observed lesson. He indicated that

We actually didn't do that in the end, it wasn't working - the kids weren't into it. We recognised very early on that it wasn't a context that they were interested in, so we changed it. ...We asked what are you interested in?

We kept the brief really broad and it was based on need and opportunities and most students produced products for a specific need. We had to change everything around, so we actually found the Maggi competition and the boys were really into competitions and so we thought that we would give it a go...

There was some supporting stuff within technology from the Maggi site and we thought if we blog, as a way of reaching an audience, through literacy, and we use this competition, because students love competition.

It worked out really well... they had to develop an existing outcome and the brief was to develop a product for a specific need, so the students would recreate it using a Maggi sachet... I wasn't happy about that but they used that because it was part of the competition and they had to write to Maggi in their blog and that was their audience and they uploaded their photos to the site and they marketed that to the wider school community. (Final Interview F, Line 165)

Graham talked during his baseline interview about his view that there were teachers in the technology community who focused solely on skills development and asserted that this was not reflective of the technology curriculum (MoE, 2007). He expressed concerns that there appeared to be no accountability for teachers who did not teach the subject from a contemporary perspective. Graham

also explained that the *Nature of Technology* strand was a means to contextualise learning and focus on the evolution of technological products. His lesson did not reflect this thinking because it focused on skills development and the production of quality outcomes. Graham explained that this was because in his experience the kitchen could be intimidating for students, and he was keen to establish high expectations at the beginning of the academic year. The next section presents Helen's perceptions and practice.

5.3.5 Helen (S1)

Helen's experience of interpreting the curriculum (MoE, 2007) was limited to school-based professional development where she had attempted to understand content for application in her specialist area. When describing her experience of technology education, she explained

...Technology was new to me, and I didn't really make that a secret. I knew that I had to learn a lot. But I'm really keen to learn, you know, I really am. I look at the websites a bit and try and work it all out, yeah. Bernadette's been a great help actually. She's right next door and she's passionate, so it kind of rubs off. You know, you kind of want to know more. Well, I do. (Baseline Interview C, Line 189)

During her final interview, I asked Helen whether she had considered the introduction of food technology in the senior secondary school and she stated

I haven't, I have it on the back of my mind, I haven't thought it's never going to work, I definitely think there will be a calling for [food technology] if we put it out there. Possibly just a unit at a time, because we are not much of a technology team as far as food goes, we'd want to master a small amount and then open it up...

I spoke to Peter [Pseudonym] and I said "What do you think about us putting a small unit into Year 10 and trying it out" and it wasn't specifically food tech., it could have been the hygiene [standard], you know, that they do in PE [Physical Education and Health] and she said, "I'd be happy to give it a go" and I thought, as a team we could help each other get it right the first time, we wouldn't have too much risk of failure. (Final Interview C, Line 209)

5.3.5.1 Perceptions

Helen aligned with a knowledge and socially driven ideology because she explained that her practice was motivated by the need to teach her students the skills and knowledge required to achieve in the senior secondary pathway, which

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offered Hospitality as an option (Reinsfield & Williams, 2015; Schiro, 2008). She expressed annoyance when students minimised the subject, stating

... Other teachers laugh, because they know much I hate being asked the question, “Are we cooking today Miss?” When I get to the door, you hear about four of them say that before I come in. [I ask] “Did you do a work plan?” ‘Cause I make them, I thought that was the best way of getting around it. You do a work plan for every recipe.

By the time they get to Hospitality, they really don’t have any excuse. They know exactly how to do it. And honestly they get it down to 10 minutes, at the end of their theory lesson, even the Year 9’s. But still I say, “Well did you do a work plan?” - “Oh - no” - “Well, then of course, you're not cooking”. (Baseline Interview C, Line 295).

Helen indicated

...It’s become quite clear to me now, that because we don’t do senior [food] technology here, I’ve got to bear in mind that there are certain skills that it’s my responsibility to get through to the kids, before they start Hospitality.

It would be a little bit difficult for them, just to do a certain number of units, knowing the technology process beautifully, and [then] starting a white sauce from scratch, because we never did a unit with white sauce in it.

You know, it is possible to do, as we know. People start from scratch with subjects [in the senior secondary school] but they’re at a bit of a disadvantage if they haven’t had all the skills. (Baseline Interview C, Line 201)

Helen had organised her junior programme into a series of topics, which introduced students to a range of practical skills. She explained

I look at the Biscuit Unit and I think it’s such a good starting point for them. What I could do is consolidate it a little bit more, so instead of giving them four different basic biscuits - now that’s four weeks already without doing the safety in the beginning, and a bit of equipment and stuff. Perhaps I could consolidate it a bit more so they just do two perhaps, two different biscuits and then design your own, and done.

So when they finish the Biscuit Unit, they’re just doing meals, because they ask for it so much. That’s what they really want. And the parents want it. So they do Chilli Con Carne, they do a Pancake challenge where they’ve got to make a certain amount of mixture, and they see how high they can get, and they love it. And then they do Spaghetti Bolognese, a Chocolate Muffin, and things like that ‘til the end of the year or the end of the term, which is not long now. (Baseline Interview C, Line 376)

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Helen provided me with the workbooks she issued to students, which included tasks and recipes. She also shared a worksheet, which was adapted from Bernadette's example. This was the worksheet that students used during the second phase of the lesson observation, as outlined below. The first workbook (Year 9) included a list of resources, which focused on the rules and codes of practice for practical activities, nutritional guidelines, some information about technological processes and the properties of food (such as eggs). The recipe book included information about basic cookery and planning for food production. Helen's programme included aspects from the *Technological Practice* strand such as Planning for Practice and Outcome Development and Evaluation. She had devised a framework whereby she had

...Got a template in my mind now, where my units follow a pattern and with the pattern comes a realistic technology curriculum. So for instance, with the work plan and the orders, now I do it for every unit. I think perhaps the starting point was to get a template that encouraged us to do it in the correct stages...

I have the curriculum there when I'm planning and I try and come to grips with the level and keep it realistic more than anything. On reflection perhaps the best way to do it would be to go through the curriculum on a single level perhaps and then work out exactly where in that unit the level is evident.

... I've definitely given it thought and I've put down curriculum areas that I'm covering, but I haven't linked it formally in a way that I can say, that's my template and there are the exact places where the curriculum shows and I think that's where I could improve. (Final Interview C, Line 184)

When making comparisons between her own programme and another teacher's, Helen articulated her misunderstanding of the technology curriculum (MoE, 2007), stating

I said, "What kind of dishes did you do?" And he said, "Oh, we were doing three course meals". And I said, "Oh yeah, did your teacher follow the Technology process? Was there always a stakeholder?"

...We're doing a Biscuit Unit. ...He's probably at Level Three/Four in the curriculum.

I'm not sure how much real technology process she's teaching them, in order to get the three-course meal out as well. (Baseline Interview, Line 351)

The worksheet used by the students during the observed lesson aimed to address the *Nature of Technology* strand, specifically on the development of the Take Away phenomenon.

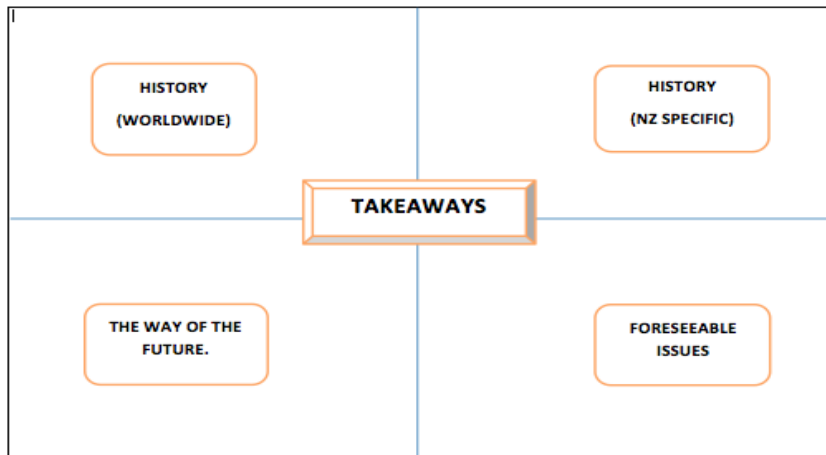


Figure 18. Worksheet focusing on the evolution of the Take-Away

The next section focuses on Helen’s classroom practice.

5.3.5.2 Classroom practice

Helen acknowledged that her teaching focused on classroom management, which aimed to maintain student safety in the kitchen. She stated

As far as the kids go, the South African kids ... kind of know their place, a little bit easier and better. When they’re chucked outside, they actually know they’re in trouble because if the Headmaster comes past, they’re in trouble. It doesn’t seem to happen here. No one really gives them a piece of their mind if they’re seen outside your classroom...

In the beginning I thought, “Well actually no one seems to care -they’re walking past the kid and not saying anything”. It’s not much of a shame, you know?

What we’ve been encouraged to do lately though, is to send them into someone else’s class. Which is a bit of a clumsy thing to do. I’ve to find someone to take them off you while the rest of the class are going crazy. But anyway, that seems to be the technique they’re using.

... If they’re really not getting down to task, I put them outside on the carpet and tell them to do [their work] there. So I can see them, they can still hear me, but they are outside. And I always warn them that it’s cold there. It’s very uncomfortable. [They ask] “Can we take a chair?” [I say] “No, sit on the floor”. I find the noise quite a challenge actually... (Baseline Interview C, Line 304).

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Helen's lesson is described below and Figure 19 provides an activity system that highlights the influence of the rule-tools and sign-objective, and subject-division of labour-objective in her classroom. The contradictions resulted from Helen's perceived professional role and the pedagogical choices that she made.

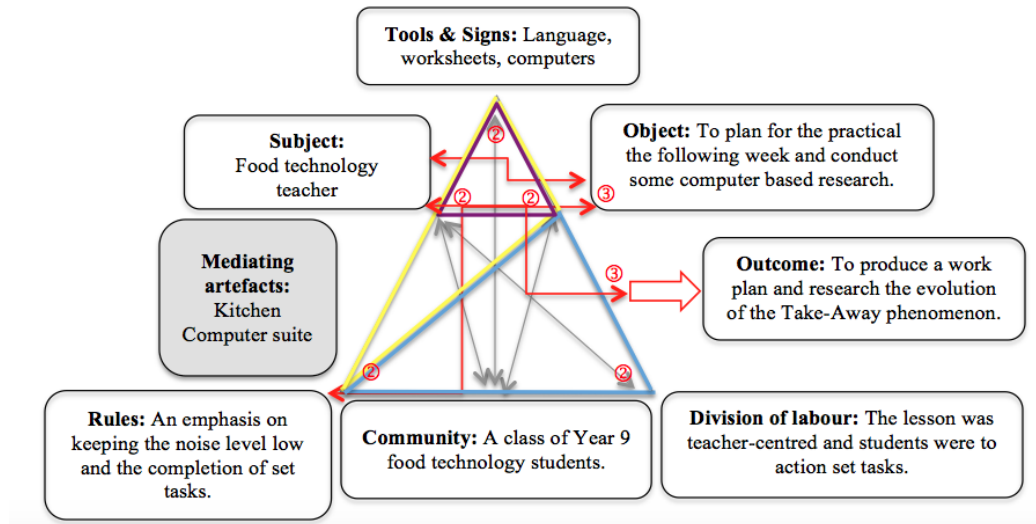


Figure 19. Activity system E

Adapted from Engeström's third generation of activity theory (2001)

Helen's lesson was with a group of Year 10 food technology students. The first half of the lesson was situated in the kitchen and students were developing work plans in preparation for their practical work the following week. Helen directed a structured lesson where she repeatedly focused on the noise level in the room, using a bell to signal to students when she wanted to speak. For example, during the introduction to the lesson, she stated

...You don't have to talk about it...(General talking)...

(Rings a bell to get students' attention)

Right... so (Students' making noise)

(Teacher rings the bell again and waits)

Everyone's attention... today's first part of the lesson is to get your order forms ready for Tuesday. That is the form, you know what you need to do, and you need everything, all key components on there.

This is probably the most important work plan for the year... I'm going to hand books out and I'll get volunteers to hand these out and then as soon as we have done all of the [work plans], then we'll move to [the computer room to] do some research. Any questions? (Lesson Observation C, Line 52)

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During the second part of the lesson students moved to the computer room and were allocated 15 minutes to complete independent research. Helen stated

I'm going to give out these little pieces of paper. They are a quick brainstorm, individual work, on the computers.

You are going to fill in four blocks on here, there's another little thing that you are going to do another day, which is called a Timeline. If you come across any dates for this, you are going to bear them in mind. It doesn't have to be in full sentences.

The reason why we are doing this is we have just done burgers; we're going on to pasta sauces, which is another convenience food. After the pizzas, we're going on to pies, which is another take-away and it's really important in the technology process to make sure that you know a little bit about the history of the topic. So, although we've done it, and touched on the origins of burgers, this is general and looking back on where have these started. (Lesson Observation, Line 17)

This learning focus aligned with the professional learning occurring within the faculty at the time, which is why the content might appear to be out of sequence. The tracking of this lesson was based on Level four of the New Zealand curriculum (MoE, 2007). Helen focused on the completion of set tasks and there was a reliance on worksheets to structure the student learning. During the data collection period, her programme in the junior school had not changed to reflect the professional learning that she had engaged in. She explained

I haven't changed it at all, it's [dependent upon] the units that go in and out towards the end of the year and how our time is and the disruptions and mostly it's the same, in the way that I present it more than anything

Liz: And have you tracked how that addresses the curriculum?

Not formally. No. I don't seem to make the time to do it. You know, I've had a look at it and I know the importance of what I'm doing but perhaps the weakest part is the level for me. (Final Interview, Line 174)

Helen explained that her understanding of the technology curriculum (MoE, 2007) was limited because of her lack of teaching experience in the New Zealand context. During the data collection phase, Helen had not explicitly determined how her junior school programme adhered to the technology curriculum concepts, although she was confident that the template she used introduced students' to some technological concepts. Helen prioritised her need to prepare students for the senior secondary pathway in Hospitality over the curriculum in the junior school context. Next, Mike's perceptions and practice are presented.

5.3.6 Mike (S1)

Mike had taught overseas without a formal qualification and then studied for a Diploma in Teaching when he moved to New Zealand. He communicated a clear understanding of the curriculum concepts (MoE, 2007) and articulately described how his perceptions of the subject translated into his classroom practice. During his baseline interview Mike described his professional development experiences during the implementation process of the current curriculum, stating that

Suddenly we got, “Here, I want Achievement Standards and here’s the new curriculum”. We were like - “No idea”. And from our point of view Google stepped in big time. Google stepped up for New Zealand huge...

But [Google] don’t do technology [education]. They are purely looking at the digital technology, computer sciences, programming, databases.

Liz: So you have to make that transition between what they’re delivering and the curriculum document or the standards?

Yeah.

Liz: So what do you think facilitates that? What helps you make that link between them?

Again, it was time - but it was with other teachers. (Baseline Interview D, Line 225)

5.3.6.1 *Perceptions*

The baseline interview indicated that Mike held strong beliefs about the purpose of technology education and was socially and learner-centred in ideology because he described a focus on learning that emphasised the development of key competencies and life skills (MoE, 2007; Reinsfield & Williams, 2015; Schiro, 2008). He acknowledged the creative nature of the subject, explaining that an open and investigative mind was more important than a fully functioning outcome. Mike shared his view that the curriculum development process had affected the way that the subject was perceived, stating

[The curriculum has] undergone a lot of changes in the time since I went to Uni. too. [Digital technology] was always seen as “the typing pool”. Technology was seen as the dumping ground. Badly behaved kids used to get sent down there...

A lot of schools have struggled to come to terms with the fact that actually it’s an academic subject and that [the] skills taught are huge.

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And I think a few Principals have struggled with that one, big time. And I think it's inherent from their childhood etc. They just can't move outside that box.

But it's changing. The perceptions are changing; things are getting there... And I like that New Zealand has said we want it to be there. Albeit painful on the teachers part! You've got to face the pain at some point. (*Laughter*)... (Baseline Interview D, Line 194)

Mike described how he planned for his students' learning, stating

I just have ideas, they pop in there, usually in the shower, ... I'm not a great one at all the detail, I'm really bad at all of the paperwork, the reports and the tracking but when it comes to the idea and the "Let's make", I'm one of those teachers.

... I read that thing [the curriculum] and I go, [students] need to be able to do that and think, I've got an idea and I think I do start backwards, I do start with, they need to be able to do... then it's like, I have an idea about how to get [them] there and so I'm not always confident that the steps are there but I'm happy that if we meet at the end, we'll be there, but I couldn't tell you the staging posts, if that makes sense. (Final Interview D, Line 199)

Mike talked about his approach to teaching his Year 9's, stating

When they come from other schools, it's very hit and miss, some haven't got a clue, some have seen [technology education]. I just kind of write it off and we all start from my starting point, because otherwise I couldn't do it and those that have done it here before, well you'll just have to help the others and you just bring the others along with you, so I just start from the beginning, so we'll wait and see whether this makes any difference or not. (Final Interview D, Line 288)

Mike described an emphasis on the key competencies of the curriculum (MoE, 2007, p. 12) and the need for students to take ownership of their learning. At the beginning of the data collection phase, there was no option for students to take digital technology in Year 10. Mike asserted during his baseline interview that

We really, really need [Digital technology in] Year 10. So they learn about taking ownership before [Year] 11. ... And my results will show you that just now - the results I've just had are quite abysmal.

So we are going to have to go back and do some tweaking, and fix them up. And half the class are going to be allowed to go on, and to create their own game. And the other half are going to have to adopt the, "This is what you're going to make..."

...They're drowning, and they can't do it. They don't have the skills to do it yet. (Baseline Interview D, Line 155)

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According to Mike, technology education provides students with the opportunity to reflect upon the learning process in which they engage to plan, make, and evaluate the development of technological concepts or outcomes. By the end of the data collection phase, Year 10 students could opt for digital technology and Mike explained that he could now focus on the curriculum concepts from the *Technological Practice* strand (MoE, 2007), stating

I only touch just briefly in [Year] 10 because I've got so many other things, so we don't really worry about stakeholders, we worry about all of those other bits and in 11, they're happy there and I can really focus in on stakeholders. (Final Interview D, Line 164)

Mike's perception of the subject was that it enabled students to work within a range of different learning contexts - if they had the skills to do so. He stated

...It has caused a couple of discussions in classrooms, where kids look at the work and go, "Look at what she did. Look at what I did."

And then you have to have that discussion, and it's very hard to do it quietly, without saying, "Yeah, but she's not as clever as you. ...It's maybe that she's not as dedicated. It's effort; it's got nothing to do with how bright you are really. You put a lot more hours into that, and she can't be bothered putting the hours in". (Baseline Interview D, Line 98)

The resources provided by Mike were shared on Google documents and were of students' work rather than being teacher-generated in nature. He indicated that in his school

[Bernadette] is a really good supportive person and she says NZQA want us to take risks. They want us to develop this curriculum, but they've got to understand if you take the risk, and it doesn't pay off... 'Cause you only get one shot every year to fix it. (Baseline Interview D, Line 419).

5.3.6.2 *Classroom practice*

Mike's lesson showed thorough coverage of the curriculum concepts within the *Technological Practice* strand (MoE, 2007), - the only strand on which he focused in the junior school setting. Mike only considered the *Nature of Technology* strand in the senior secondary school when he felt he was left with no other options due to the specialised knowledge required to achieve in digital technology at this academic level. Mike emphasised the value of specialist knowledge within his area of digital technology and reflected upon the nature of the learning in his classroom, stating

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...Some kids like the structure, they like to know what box do I tick next? And some kids don't want that.

So, in the old days, we spent a lot of time looking at attributes and expectations. Whereas now with agile programming, or [an] agile method, they'll make something, review it, make it, review it, make it, review it.

So you're working on your product all the time [whilst] you're still planning it. You don't have this big planning phase and then the making phase. You have to make, and plan, and do - all at the same time. (Baseline Interview D, Line 346)

Mike described some difficulty associated with an iterative approach to technology, indicating that with his Year 13's

They started making the robot and they made, tested, made, tested all the way through prototyping. Tweaking, fixing, turning - so they've done it. But they kind of got lost and involved in so much of the process... Then three weeks later the kids went, "Oh I haven't blogged for like, three weeks".

...So I think I just need to bring that together better next year. I still want to do the project because they got very engaged and they did really like it. And they really did do real prototyping. (Baseline Interview D, Line 356)

Mike's observed lesson was with Year 9 digital technology students and focused on the conceptual development of a website. Students were expected to communicate how they would design their website by developing a PowerPoint.

Mike described the project, stating

...So even at [Year] 9 now, they do a little website project on PowerPoint, on what you want, "What do you want to do it on? You choose a topic". And again, we're starting to get much broader things. So we're trying to teach them about time management and ownership from Year 9.

But that needs to go into [Year] 10, so that you've got it further along. And they have to have that ability. Otherwise we're not preparing them for life. And you can't teach it on a board... they have to experience it, and they have to experience failure... and you try and teach them that failure's not failure. Failure is a learning curve. (Baseline Interview D, Line 179)

Mike's lesson was aimed at Level four of the New Zealand curriculum (MoE, 2007). There were three main phases to the lesson, including the introductory section, which focused on reiterating students' understanding of "attributes". Next students worked independently to research existing websites. Finally, Mike

showed students previous examples of work to support their understanding of the project’s requirements. All phases of the lesson contributed to the intended learning outcome of the lesson. Mike encouraged dialogue as appropriate amongst students to assist in their construction of new knowledge. He occasionally reminded them of his expectations around behaviour so that there was a focus on the learning. This is presented in the activity system in Figure 20.

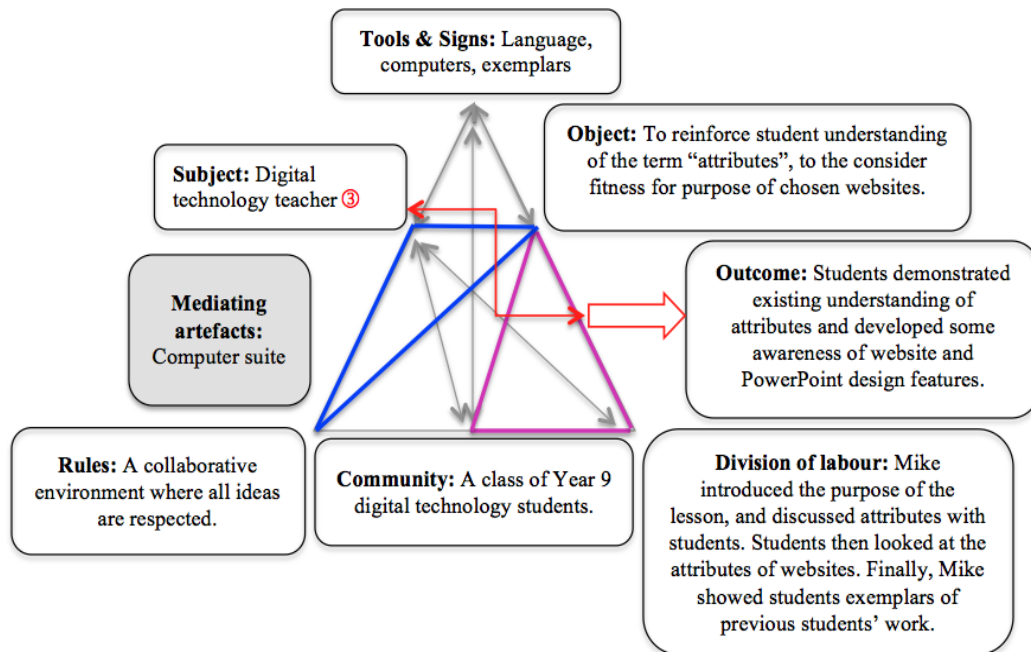


Figure 20. Activity system F

Adapted from Engeström’s third generation of activity theory (2001)

The sub-systems of influence for Mike were subject-rules and division of labour-community-objectives. The contradictions were caused by the way that he contextualised learning for his specialist area of digital technology. Mike used a range of strategies to engage his learners during the observed lesson, where he stated

Today then, we’re going to start our web design project. We’re going to create a prototype... now, why do you think people would create a prototype? And why would you want to create a website prototype?

(Teacher repeats student’s answer)... To test it out to see if it will be successful. Yes, exactly... Now, secondly... if we’re making a prototype, to test stuff out, to make sure we don’t stuff up the real one, why would we make a prototype website?

... So in PowerPoint, you can create a mock-up of a website. It can have hyperlinks, buttons, graphics, video, it can have all the things that

a website has, without the coding. So what are the elements of a website? (Lesson Observation D, Line 43)

Mike described his perception that digital technology could encourage students to take risks in their learning, experience failure, and develop their skills in self-regulation. The observed lesson appeared to reflect this view, and Mike made connections to the technological concepts from the *Technological Practice* strand of the curriculum (MoE, 2007) when interacting with students and in the activities that he had designed. He acknowledged some concern about the creative and self-regulating capabilities required of students in technology education and his ability to track such processes for the purposes of curriculum adherence or NCEA assessment. The next section of this chapter focuses on the emerging data from the professional learning in each school.

5.4 Teachers' understandings

There were a range of representations in relation to teachers' perceptions of the curriculum, and engagement with its concepts, which confirmed that there is an ongoing need for teachers to engage in professional learning about the curriculum (Bell & Reinsfield, 2012; Bungum, 2006; Cowie, et al., 2008; Chikasanda, et al., 2011; Jones & Carr, 1992; Jones & Compton, 1998; Williams, 2013).

The findings indicated that Bernadette, Colette, and Helen were all relying on their habitual knowledge (Määttänen, 2015; Meyer & Land, 2003; Perkins, 1999). Helen made few personal attempts to engage with the concepts from the curriculum and her teaching of them appeared tokenistic in nature. By the end of the data collection phase, and when Colette had been exposed to whole staff professional learning in her new school, she had begun to engage with the curriculum and make meaning of it to develop her knowledge for practice. Alice, Bernadette, Graham, and Mike applied some of the technological concepts to differing learning contexts - with a range of success. The ways that teachers engaged with, interpreted and enacted the curriculum led to insight into the knowledge that they were finding troublesome. Figure 25 shows where each participant was positioned, based on their understandings.

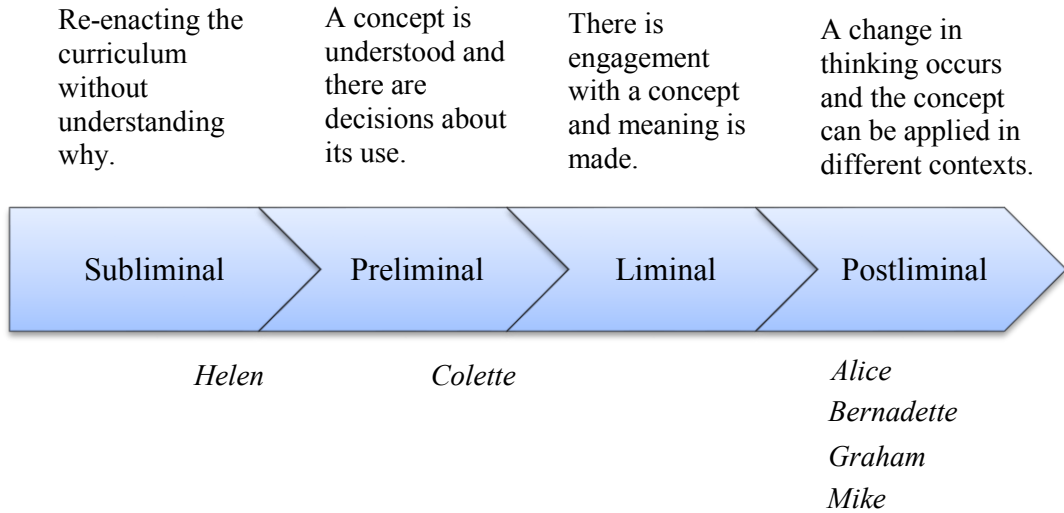


Figure 21. The liminal space positioning for participants

Adapted from Meyer, et al., (2008)

The next section describes how teachers’ understandings of the curriculum were represented through their emerging troublesome knowledge, and liminal space.

5.4.1.1 Connecting liminal space and troublesome knowledge

Troublesome knowledge is conceptualised in this research as understanding that is “alien, counter-intuitive, ritualized, inert, tacit or even intellectually absurd at face value” (Meyer & Land, 2003, p. 2). Tacit knowledge for example, is interpreted here as being based upon information inherent to the practitioner’s perceptions; it is difficult to articulate, subjective in nature, and manifests during a particular activity.

5.4.1.1.1 Alice

There was a tension between Alice’s espoused (future-focused) perceptions and the way that this was translated into practice. She explained that whilst she had a learning goal in mind (Stoll, et al., 2012) she had found it difficult to manage a large and challenging group of students who were working collaboratively on a class project.

Alice explained that because of student disengagement, she had to cancel the Formula One car project. In Alice’s case, her classroom management, content knowledge, and the students’ understandings limited her practice. Alice appeared

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to be challenged by the combination of constraints upon her practice; she was leading a class project about car manufacture, yet the knowledge she needed to do so was conceptually challenging for her (Meyer & Land, 2003; Perkins, 1999). In this case, it was not Alice's understanding of the curriculum concepts limiting her practice but instead her inability to support the needs of her learners in a newly conceived learning context (Zuga, 1989).

5.4.1.1.2 *Bernadette*

Bernadette had a national reputation for her work with the technology curriculum and is positioned at the post-liminal stage of understanding. She acknowledged however, that as the new head of faculty, her practice remained inert and ritual in nature because she was tasked with supporting her colleagues' evolving understandings of the curriculum. This is where the knowledge she found troublesome emerged. During the department meeting Bernadette provided food specific examples for Helen, whom she knew was experiencing difficulty when interpreting the curriculum, for her own specialist area. The examples Bernadette provided appeared confusing to Helen who was looking for strategies to apply in her own area of technology education.

During the department meeting Bernadette made reference to "pies", to contextualise the Characteristics of Technology (CoT) and the Characteristics of Technological Outcomes (CoTO) components of the curriculum (MoE, 2007). Specifically, this pie example could address the CoT component if there were discussion about how pies had evolved over time to become popular in the New Zealand context. The nature of the pie, including why it had developed to have pastry outside and had different types of meat inside it could relate to the CoTO component because this concept addresses fitness for purpose. The notion of fitness for purpose considers physical and functional attributes, products developed for a specific purpose and the influence of a social and historical context (MoE, 2007). This finding highlights that if a head of faculty's knowledge of other specialist areas in technology is alien or inert, there are likely to be implications for some leaders of curriculum whom are expected to provide appropriate professional support (Meyer & Land, 2003, Perkins, 1999). There is the risk that misleading examples can be volunteered, which further confuse

practitioners who are already experiencing difficulty making meaning of the technology concepts, for their own specialist area.

5.4.1.1.3 Colette

Colette acknowledged that her knowledge of the New Zealand curriculum (MoE, 2007) was evolving because she had been in the country for only a short time. She argued that rather than her enactment being constrained by her own understanding of the curriculum, it was the discourse in Lakeside Academy, which was reflective of elitist perspectives about the role of technology and the suitability of students for different roles in society (Hill, 2003; McLintoch, 1966; Reid, 2000; Williams, 2013). Such an approach would counter the view that technology education should be an entitlement for all students, irrespective of their ability and skill (Ferguson, 2010; Kimbell & Stables, 2007). In Lakeside Academy, Colette felt that the nature of the class was not the result of political influence but rather Bernadette's hierarchical attitude towards wood as a material (Pinar & Bowers, 1992).

The evidence suggests that Colette's understanding of the technology curriculum was at a pre-liminal stage. For example, she described her difficulty when engaging with some of the curriculum support material, to interpret the concepts for her own specialist area of hard materials. In this case, it appeared that the knowledge she needed to make meaning of the technology curriculum was alien to her (Meyer & Land, 2003; Perkins, 1999).

5.4.1.1.4 Graham

There was no evidence to suggest that Graham was experiencing troublesome knowledge or that he needed to transition any liminal space in relation to his understanding of the curriculum concepts. He recognised a need to accommodate all three strands of the curriculum in his teaching, whilst being responsive to students' interests. Graham's data indicated however, that his practice was being limited by the organisational structures within the school (See Section 5.3.4). His enactment of technology education was minimised by the need to respond to student need within an integrated curriculum and under pressured timeframes.

In this instance, Graham's intended practice had to accommodate another learning area's needs in a manner that positioned technology education as being useful for

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its practical nature rather than as a subject that provided valuable learning in its own right. Graham appeared to have to be reactive rather than responsive in his planning, which had implications for his ability to make informed and meaningful connections to the curriculum. He acknowledged that the resulting learning focus was counter to his self-concept as a food technology teacher (Roche & Marsh, 2000; Shavelson, et al., 1976); the learning that eventuated included curriculum connections to a “Brief” (in the *Technological Practice* strand) before students replicated an existing outcome. Graham understood the curriculum concepts and how they could be applied in practice but because of the constraints placed on his practice within an integrated curriculum, he reverted to ritual knowledge (Meyer & Land, 2003; Perkins, 1999), which focused on the replication of pre-existing outcomes. In this instance, he did not appear to maximise the potential to explore learning opportunities outside of the *Technological Practice* strand.

5.4.1.1.5 Helen

Helen was trying to incorporate concepts from the *Nature of Technology* strand during the observed lesson but did not have the knowledge to enable this. She appeared to find the curriculum concepts both conceptually difficult and alien (Meyer & Land, 2003; Perkins, 1999). Helen was using Bernadette’s resources to support her teaching. Helen’s dialogue during the classroom observation suggested that her understanding of the *Nature of Technology* strand was limited to the history of a product’s development, and her instructions emphasised expectations around behaviour and a technical approach to the task. What appeared to be troublesome for Helen was the notion that students’ practice should not be derived from the production of outcomes in order to develop the necessary skills for a successful transformation to the senior secondary Hospitality programme. She had chosen not to engage in any personally deliberate way with the concepts from the curriculum and addressed them by developing a template driven approach for each of her junior school projects. Her practice gave the impression (during department meetings) that she was engaging with the curriculum when in fact, she was replicating others’ ideas and continuing to practice in a manner that reflected historically placed practices (Paechter, 1995). It appeared that Helen’s key issue was her ability to develop culturally appropriate

pedagogical responses, which were contrary to those that she had experienced overseas (Glynn, 1998; Quezada, 2004; Sharplin, 2009).

5.4.1.1.6 Mike

What Mike found troublesome was not the interpretation of the curriculum or indeed it's enactment but how he managed this process to track students' coverage of the technological concepts. He indicated that whilst he felt confident that he was meeting the curriculum requirements, there was not always the evidence to substantiate this. Mike asserted that he might not explicitly cover certain curriculum concepts within this delivery, but felt that students would intuitively develop their understandings of technology as a result of the projects with which they engaged. Mike's coverage of the curriculum was based upon a process-driven perspective, which relied on his ritual and inert knowledge (Meyer & Land, 2003; Perkins, 1999). He consistently sought new ideas to enable engaging learning contexts. What he found troublesome was how to make explicit links between his knowledge, planning, and practice. The risk with such an approach was that Mike was not developing his understanding of the curriculum within differing learning contexts but was instead basing his ideas upon what he determined students needed to know for their successful transition to the senior secondary school context.

Each teacher's understanding was connected to their experience of teaching technology, their engagement with the curriculum, and the school-based circumstances that were mediating their practice. The findings suggested that there were pervasive and historically based assumptions about the nature of technology education in both schools. Fortunately, the data also indicated that if technology teachers were motivated to challenge others' thinking, engage in dialogue about the subject, and support community understandings, these assumptions could be reconceived.

5.5 Professional learning

The purpose of observing teachers during their school-based professional learning was to determine whether their espoused theories and practice were mediated according to their socially constructed context. Key to this notion was the interest in "how interpersonal activity, including tools and/or language, became

transformed into intrapersonal, mediated thought” (Engeström, et al., 1999, p. 412).

As described in Chapter four, Lakeside Academy was a well-established school with a newly appointed head of faculty, who had an established reputation for the effective teaching of technology education. Within this Faculty, both Mike and Helen were teachers in charge of their specialist areas of digital and food technology respectively. Alternatively, Greenhill School had just opened and was an innovative learning environment in its establishment phase. This Faculty was lead by Alice, an experienced teacher of product design, with support from Graham, a subject leader of food technology. There was also Colette, who was a teacher of hard materials in both schools, and had moved from Lakeside Academy to Greenhill School during the data collection phase of the research. The next section introduces the circumstances within each school and the nature of the professional learning that the technology teams engaged in.

5.5.1 Lakeside Academy (S1)

Lakeside Academy was a school with a reputation for emphasising academic excellence. Before the data collection phase of this research, Lakeside Academy’s technology teachers had participated in a national online discussion forum, which was facilitated by the University of Otago and had included a number of schools across the country. During this online forum, all department staff were exposed to information about the *Nature of Technology* strand as it is conceived in the official curriculum (MoE, 2007). Bernadette explained her aim for the professional learning, stating

I guess it’s like looking at the nature of the technology curriculum - Back in its historical days. I don’t want to bore them, and we have limited time...

But I want to give them some really good examples. I think if the light comes on, that’s where we are at the moment.

We’ll give people a chance to get going. I think we’re going to have people who will go off on the wrong tangent. There’s no doubt about that. But generally I think the staff here are really starting to get interested in what we are doing.

A lot more than it was before I took over, because I was doing it myself and I didn’t have to worry about anybody else. I think that was good for

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me, because I didn't have to worry about any of the administration stuff...

When people start to waffle about something that's not right, it's no good arguing with them, or getting into conversations. You just move them on. (Baseline interview B, Line 276)

Bernadette identified that she was conscious of teachers' views of technology education, stating "I struggled to talk to [another technology teacher] about it because he's a tradesman, and I've come from the Trades too... they want the answers, that's why" (Final interview, Line 231).

During the observed department meeting, Bernadette, Helen, and Mike were focusing on the *Nature of Technology* strand of the curriculum (MoE, 2007).

Bernadette explained her rationale, stating

...It gives us that depth in our projects, the depth of knowledge for the students from the "get-go", and I know that there are people here saying that I've got to get my kids to know more about a product and get them to look at a product properly, you know, existing products and that sort of stuff and this is exactly where it comes from. (Department Meeting LA1, Part A, Line 8)

During her interview, Bernadette had described the work that her faculty was doing to interpret and enact the *Nature of Technology* strand of the curriculum (MoE, 2007), indicating that

We're concentrating on Characteristics of Technology at the moment, so that we've gone through, and we've looked at what that says in the document, and the Teaching and Learning Guides. I guess the best way now is to look at delivery of it. 'Cause that's when people can relate it to what they're doing in their class. (Baseline Interview B, Line 249)

Bernadette also explained

[Teachers] don't need to know all the stuff that I've learnt, because that's taken years. But if we can get them to move forward, as we start teaching it, then their understanding will grow as well... (Baseline Interview B, Lines 258)

During the department meeting Bernadette provided examples of the type of learning that could occur in the specialist area of food technology, stating

So what we are looking for at the moment is just Characteristics of Technology, so that's just the bigger picture of it.

Okay, so if we were doing it on a pie we would be looking at why has a pie got pastry on the bottom and meat inside, what sort of flavours of

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meat are in it? We're looking at the bigger picture around why is a pie a pie and how has it developed and where does it fit in to what we do and what's influenced it and things like that.

Put in the context of fast foods and what about having something there that is generally nutritious and how can you cart it around and re-heat it. So it's not about the meat inside it but about the bigger picture of it. (Department Meeting LS1, Line 17)

The activity system in Figure 22 illustrates the professional learning activity system for the department meeting, in a context where the emphasis was on subject-tools and signs, community-division of labour, and the subject-rules-division of labour sub-activity systems. Bernadette directed the discussion in her role as the head of faculty. She positioned herself as the expert and determined the discourse within the department. During the meeting Bernadette acknowledged that the information being disseminated was based on her perspectives, which resulted from extensive experience of teaching technological concepts at a variety of year levels.

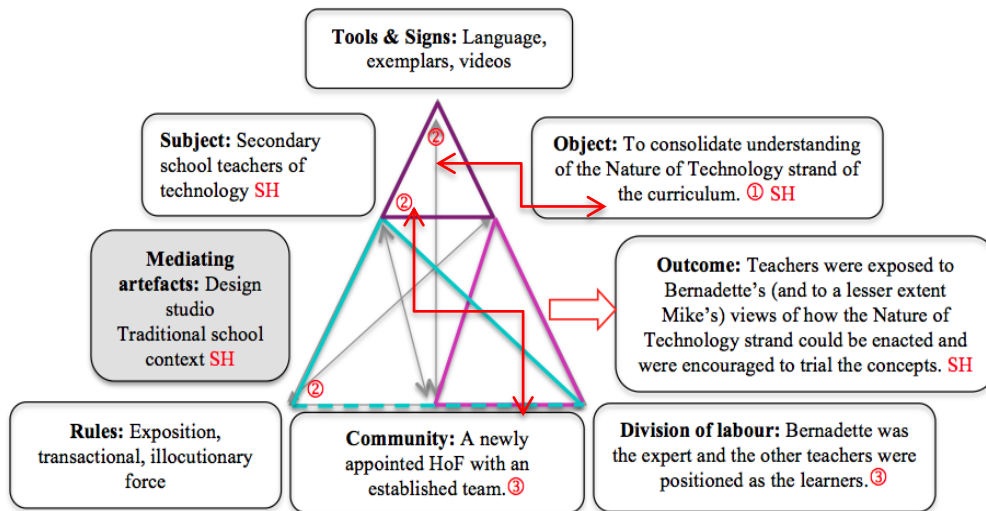


Figure 22. A professional development activity system for Lakeside Academy
Adapted from Engeström's third generation of activity theory (2001)

Both Bernadette and Mike used illocutionary force through the rules they established during the meeting, to assert their beliefs in their own practice within their culturally defined setting, and to reinforce how the technology curriculum should and could be interpreted and enacted. There was some tension between the ways that Bernadette and Mike perceived how the *Nature of Technology* strand should be taught. This is illustrated in the dialogue.

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Mike: If I showed you the latest mouse, it's a tiny little cube about 2 cm big and it sits on your desk and it turns your hand into the mouse.

Bernadette: So you're looking at the specific product? You're looking at Characteristics of Technological Outcomes; you're looking at the outcome itself...

Mike: Well yes and no. We're looking at the mouse and we're looking at the story of the mouse because it's not just the mouse any more, I mean, you wear suits now and you have a 3D environment... How will we interact with the computer at the end, what's it going to look like? By the time [the students] are forty, what's it going to look like then? It's how we interact with the computer. The mouse is just the vehicle.

Bernadette: It would be really good to see if you could plan it so that you could look at the Characteristics of Technology of the mouse and why it's developed without looking at the physical parts of how it has developed. You know, it's developed to become portable. When you look at the mouse, you look at the specific mouse itself in terms of its Ergonomics, so that's the outcome itself...

Mike: But we have to do that to understand it... (Department Meeting LA1, Line 217)

Throughout the meeting, Bernadette checked for understanding of the concepts being presented and emphasised the importance of the *Nature of Technology* strand for students' understanding in technology education. She regularly focused her attention on Helen who she had indicated was experiencing difficulty engaging with the concepts from the curriculum but had also expressed a motivation to develop her knowledge for practice. During the meeting, Helen referred to the worksheets being used by Bernadette and asked questions about their application, as illustrated below

Bernadette: So they just fill out this product reading sheet... So you know, you're extending understanding at Year 10 level, to be able to identify these attributes and bits and pieces and apply that to their product design...

Helen: So, almost working backwards?

Bernadette: Yeah.

Helen: And then they are going to take it from there and move forward? ... So you think that we should do that in Year 10... and in Year 9 as well?

Bernadette: [*Nods*] Year 9, if you want to. (Department Meeting LA1, line 359)

At the end of the meeting, Bernadette indicated

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I guess the next move for us is to try and do something with this with our junior classes. We can share it with each other later on in the term.

All right, so as long as we all have a go at it okay? It supports what we're all trying to do and I think that's really good as well.

What I suggest you need to do is if you are going to do it in Year 10, is have a look at the Progression Indicators and see what it's asking to be done.

This [*holds up the exemplar*] is more Year 10, Year 9 will be simpler. If you think this is a good starting point, I guess you can make these, why go backwards as long as you read what you are meant to cover and as long as you think well I'll move them to this stage, I haven't missed out anything that could be important. ...I can't tell you what the Progression Indicator says for [the] Nature [strand]. But have a go at Year 9 if you want to, there's no right or wrong really, is there? (Department Meeting LA1, Line 618)

The focus for professional learning in Lakeside Academy was on the *Nature of Technology strand* because Bernadette had acknowledged that this was an area of the curriculum where she needed to foster teachers' shared understandings. As the head of faculty, she disseminated her knowledge, based on her professional experience, and engaged in some dialogue about Mike's differing interpretation. Bernadette provided specific examples for Helen, with a view to contextualise the curriculum concepts from a food technology perspective (MoE, 2007). The next section identifies the nature of the professional learning in Greenhill School.

5.5.2 Greenhill School (S2)

Greenhill School was promoted as being learner-centred in nature, with a view to respond to students' holistic well-being and interests (Schiro, 2008). I attended two meetings during the data collection phase. The first was conducted in Term Four (2015) when staff were still establishing collegial relationships and developing shared understanding about the "essence" of the school and the place of technology education within both an integrated curriculum and innovative learning environment. The second meeting was during Term One (2016) when students were in attendance and the teaching was underway. When describing the school context, Alice stated

I'm amazed at the diversity [of teachers] that is actually here, which is a good thing because you've got to be really careful if you get a school full of type A personalities, it won't last.

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So there is diversity but the school has been quite lucky and they can be choosy and also they have been choosy. They have got their criteria and they don't appoint unless they get there.

We are understaffed and they put an advertisement in and get a couple of hundred applicants and they interviewed 40 people for 20 positions and appointed 10. (Baseline Interview E, Line 71)

5.5.2.1 Meeting one

The Principal had determined the focus of this meeting; he wanted staff to consider what the “essence” of their subject was and how this might manifest in their future teaching approaches. At this point, students were not attending the school and teacher dialogue was conceptual in nature. During the meeting, Alice led the discussions but asserted that she did not want to be perceived as being in a position of authority. She encouraged contributions from all teachers present, including Colette and Graham who were participants in the research. Much of the discussion during this meeting was centred upon technological terminology and the intent of the official curriculum (MoE, 2007).

When describing the learning contexts within technology education, Alice expressed her concern about the assumptions made about the nature of the subject. She stated “It comes back to what are we going to call ourselves and so we could just call ourselves design but we make stuff as well, that's our point of difference” (Department Meeting GS1, Line 64). Alice opened the first meeting by stating

The purpose of this meeting is just to have a chat and really look for the common understandings of what we do. ...We have a common interest in technology and so we'll have a look at what it's going to look like and how its going to be, in the same way as we have a module meeting and everyone who wants to run that module decides what we are going to do.

So although I'm talking, I'm certainly not the leader and everyone's opinion is valued and necessary. Questions, answers, concerns?

If we want to talk about what the essence of technology is and that's all we really want to do this time, I think. (Department Meeting GS1, Line 23)

During discussions, Graham sought clarification by asking

Graham: What's this for? Is it for the overarching essence of what technology is? ...To be put up somewhere?

Alice: Yeah...

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Graham: Oh, right...

Alice: Necessary, or don't worry about it?

Graham: Does it have to be a sentence?

Alice: Like that "design, make, create", or "design, make, innovate"...

Graham: If you look at Technology Online, it's design and technology. What would our kids think about that?

Alice: Innovative technology?

Graham: What's technology, what's innovation?

Alice: Because innovation is design, make, create isn't it? If we end up selling ourselves with that label...

Graham: We have also got to think about what the high school are going to call themselves so that we are using the same language. Yeah, that's another issue, isn't it...Park it... (Department Meeting GS1, Line 84)

During this meeting there was an emphasis on the development of relationships within the new team. Social conventions (between the team) were not yet established and at times teachers were talking together, not listening to others' contributions, or having conversations in smaller groups. Colette and Graham contributed occasionally and sometimes only when prompted by Alice, who asked

Alice: What do you people think technology is?

Graham: Ideas informing future decision-making... Understanding relationships between each [learning] area...

Alice: [Colette], it's not like you to be quiet?

Colette: I'm trying to look smart but I'm thinking (*Laughter*) ... Fit for purpose?

(Together)

Alice: Lead the way to the curriculum, awesome!

Colette: Just throw those words around...

Graham: Done.... (Department Meeting GS1, Line 35)

Figure 23 presents the activity system for the first department meeting and identifies an emphasis on the rules-division of labour objective sub-system.

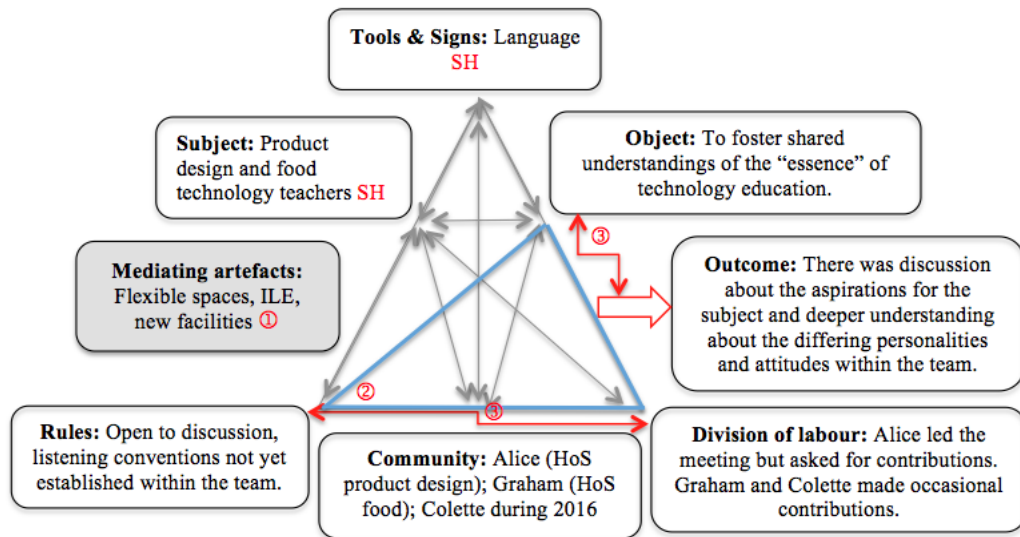


Figure 23. A professional development activity system for Greenhill School

Adapted from Engeström’s third generation of activity theory (2001)

During his final interview Graham reflected upon the school’s curriculum structure and indicated that the senior management’s mandate asserted that teachers

Needed to stay true to our curriculum area because if we don’t, it will just be surface learning...

I met with two others and we’re teaching “Fusion” foods and we’re planning together. They’re very strong in literacy and I’ve got the curriculum knowledge in terms of technology... I was thinking “Oh my word, what if they don’t understand the technology curriculum? How will I explain that so that they understand it and how do I stay true to my curriculum area so that students get the depth and breadth of it, as much as they deserve?” (Final interview F, Line 65)

To contextualise such a focus, Alice asked teachers to describe their anticipated learning activities, and both Colette and Graham contributed. These descriptions serve as indicators to participants’ view of the nature of technology education. For example, Alice explained that one of her projects was called

“Rebel Sports” ... because the idea is that it’s got to be a crazy game, it can’t just be a game of tennis or cricket, it’s got to be a made up game or something.

One of the things that we are doing is that students have to choose a letter out of a hat, and they have to report back on a sport that is played in a country with that letter. So, what are the rules?

[They] look at the game and make the connections with the culture of that country... (Department Meeting GS1, Line 394)

Graham too, described one of his projects

... So food and literacy are paired and we are going to be connecting relationships through food and we'll be doing that through story telling.

It could be in any shape or form, we are leaving it really open and we're thinking that lots of different things could happen, like authors coming in, you know, we all have a story to tell, where learners can go ahead and do a food blog or create products by going out into the community, and keeping it very open. (Department Meeting GS1, Line 330)

Colette was not teaching technology during the data collection phase at Greenhill School, but she did make an interesting observation about the tensions she had experienced during her first year of teaching technology education at Lakeside Academy, indicating that

... You go to the kids and you say, "Now you're the stakeholder but you are going to build this" and then you say "So why are you building this?" and it's like, "Because you told me to" ... Then it's like, "The teacher said I had to make this...". It's like, "You can have any colour you want, as long as it's black. You can do anything you want in technology as long as it..." (Department Meeting GS1, Line 250)

5.5.2.2 Meeting two: The "essence" in practice

The planned focus in meeting two was on Differentiation, Solo Taxonomy and reporting to parents. However nearly half of the meeting's duration consisted of dialogue around the barriers to learning that the teachers were facing. Discussions centred on student engagement, subject hierarchy and the assessment approaches being adopted across the school. Graham and Colette were not in attendance but other team members were. Alice led the meeting and expressed her concerns about the nature of the teaching that was occurring, explaining

We've done quite a bit on outcome development and identifying needs, that design process part and not so much about the technological practice and we're probably, a lot of us, haven't used that place [the workshop] as I'd like to, I'm still setting it up but we're not quite there yet because we've got this idea that the students are going to be doing different things which would be amazing, and they're all working at different levels and that's difficult to manage. We haven't lost sight of that but we've been working on integrating the subject areas and the technological process, the design process and so we probably haven't found that...

It's interesting how we've all struggled with... You'd think that maths and technology are a natural fit but we've all struggled with it...it's not

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entirely the subject of maths, it's the way that they think as well... We need to be more sure where we are going...

I was 50-50 [time between curriculum areas] but we're down to doing three rotations and the students are now doing two maths and a technology. You see, I'm not a maths person and I thought it was 50-50! (Department meeting Two GS, Line 233)

Alice also indicated that

...Because we only have students for two hours a week for 10 weeks, we are only doing technological practice and we're teaching students process.

The Principal has sent a few kids down to me who are making a skateboard ramp and I say, "Yeah, we can do that, just bring me a plan" and I never see the kids again. I explain what a plan is to them and I want to work with them but I've just been a bit busy.

If they come with something that shows what they actually want to make I will work with them and if they are happy to come at lunchtime, that's fine, but just coming back to that constraints thing, I mean that is a real issue, I mean we are constrained by the knowledge and the skills that they have and what we're trying to do is that they'll often come up with "pie in the sky" type things. (Department Meeting GS2, Line 25)

She also explained

I looked at the last [module] and thought that we didn't do as good a job with maths as we could of and we didn't do as good a job of technology as we should...

I don't believe it's a time thing. I think it's an establishment thing.

We had a couple of conversations with the maths person [who thinks] it's not maths unless it's got a line down the middle and a date on it. There are a lot of fixed Mind-Sets.

I had a great conversation with Ewan [Pseudonym], who said, "I feel like I need to do some specific teaching around maths" and I said, "Is that to make you feel good or is it because you have established a hole?"

We're constantly falling back, and I find myself doing it, thinking, "I've got to do this", and "I've got to do that" but no, you don't. (Final Interview E, Line 157)

Alice reflected upon these constraints again during her final interview, expressing concern about the way that technology education was being perceived in the new school. I clarified an earlier conversation with her, asking

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Liz: Maybe I've misinterpreted the intention? Is it that you are the specialist teachers and you will deliver the technology in collaboration with other teachers or that there will be non-specialists delivering parts of the technology curriculum, alongside other areas?

Both. My job description is to ensure that the intent of the technology curriculum is kept alive. That doesn't mean that I'm responsible to ensure that it's covered or if I think well it's not that important, it doesn't matter, then in theory, that's okay.

I just need to get my vision across for it and the team's vision for technology. Last year we were a small group and this year we've got more people on board... now the teams have to spread themselves around. So we've got a whole lot of people coming to our technology meeting that maybe it's not their first choice and it's certainly outside of their comfort zone so we need to empower them to be passionate about technology.

I need to think about this a bit more. I kind of think what is the best way [is] I think just take them there and make stuff and then over a period of time tease out... have you thought about this and that? You can teach all of the Nature of Technology and Knowledge that you like but you can get into a class and realise that the kids, they need some guidance and some training. You can't just bowl in there and cook some stuff kids. (Final Interview E, Line 318)

Graham also reflected during his final interview, that he needed to find ways to develop understanding of the nature of technology education between staff, stating

I was just talking to some of the Co-teachers the other day and we were talking about how we want to get on TKI and we want our students to feel like they are achieving.

I think we have started off small... and you constantly see teachers coming in and giving feedback to students and the door is always open.

Lots of teachers are saying, "Hey, I'll be your stakeholder", they're using the language; they don't necessarily know what that language [means]. We're constantly thinking about evolving. (Final Interview F, Line 192)

During the first meeting at Greenhill School there was a focus on fostering a collegial environment for teachers who had a common interest in technology education. There were some initial concerns raised about the assumptions made by the community about the nature of the subject and the level of support that technology teachers might need to facilitate learning within an integrated curriculum. At this point the discussions were based upon teachers' previous

teaching experiences. During the second meeting the conversations centred on the reality of the new school environment, which was causing technology teachers' some difficulty in teaching their subject in a collaborative fashion. It appeared that whilst some teachers in the school were attempting to use appropriate terminology, the subject was being marginalised when it was paired with learning areas like mathematics and English. The participants suggested that the role of technology was being determined by its practical nature and there was concern about the view (from senior management) that non-specialist teachers could manage a practical class without any understanding of the subject. The next section identifies the findings for each of the school contexts.

5.5.3 The social settings

The following section presents the findings from the two differing school contexts. In Figure 24, Object 1 relates to the factors that have affected the nature of technology education in each school context. Contradictions are represented as primary (within the elements - ①), secondary (between the elements - ②), tertiary (tensions in practice - ③) and quaternary (tensions between curriculum and practice - ④) in each of the activity systems. The primary contradictions identify where the governmental agenda has affected the nature of technology in each school setting. The secondary level identifies the tensions that manifested within teachers' practice. Identifying contradictions in research are a means to promote conceptual change, consider perceptions, and recognise existing challenges to practice (Kang, et al., 2005; Roth, 2013; Singer & Voica, 2008). Comparisons have been made between the two systems to identify the tertiary contradictions in Object 2, as represented in and to indicate opportunities for change (Engeström, 1987). Object 3 identifies the enablers for change (as the result of concrete pedagogical examples provided in Object 2) and for further discussion in Chapter six.

Figure 24 illustrates that the two school contexts were different in terms of the style of leadership, curriculum structure, and expectations of staff. For example, with regard to the curriculum structures in each school, Lakeside Academy provided student exposure to a range of technological areas via a rotating timetable, and Greenhill School was using an integrated approach to curriculum.

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The key features of Figure 24 are organised according to the activity theory framework as introduced next.

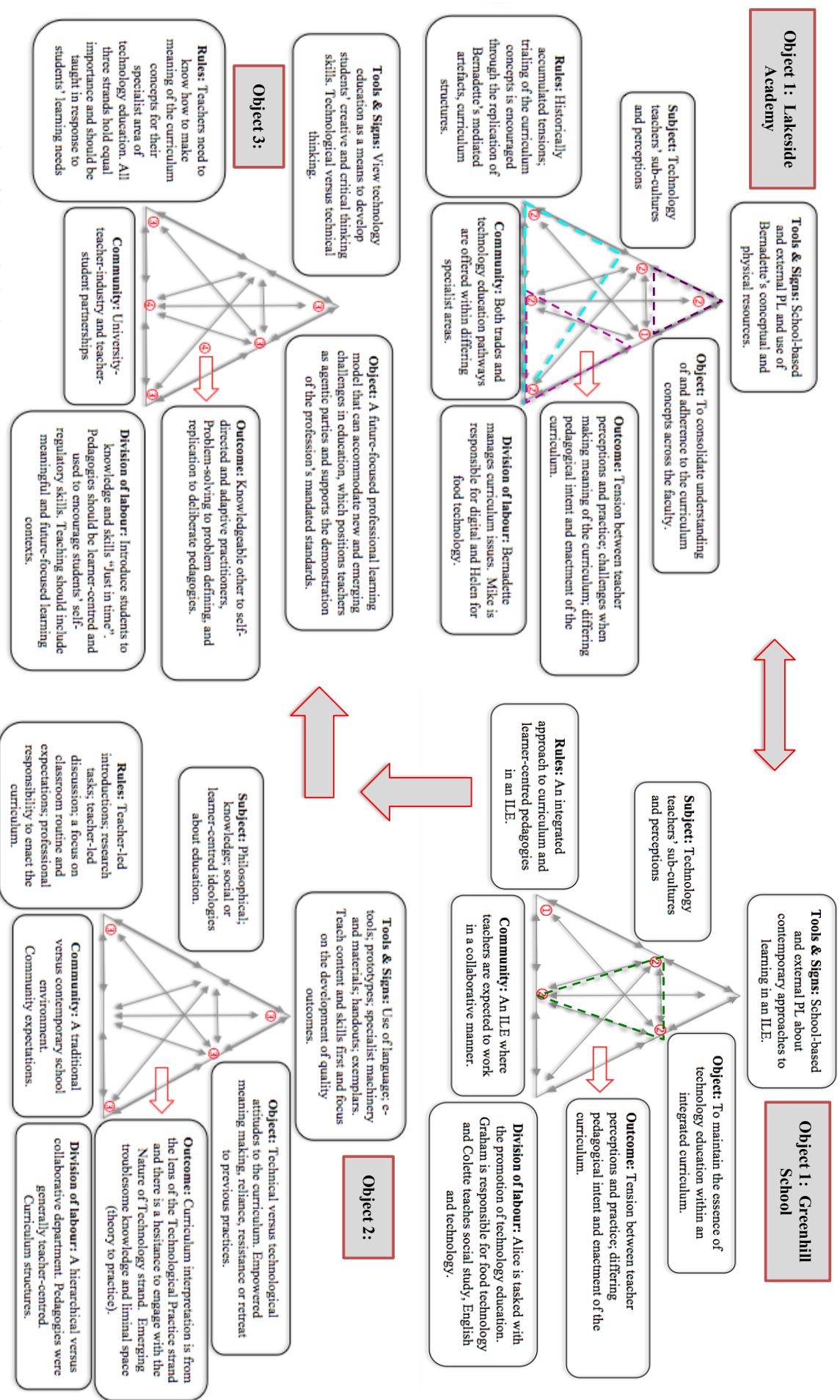


Figure 24. A comparison of the two school settings

Adapted from Engeström's third generation of activity theory (2001)

5.5.3.1 Tools and signs

Tools and signs are defined in this research as the theoretical ideas and resources used to develop teachers' understanding of technology education. At Lakeside Academy, participants described both school based and external professional learning, as well as their past teaching experience as a means to develop their understanding of the curriculum (MoE, 2007). Bernadette offered her conceptual and physical resources to support colleagues' professional learning through paper-based, e-based (PowerPoint and video), and transmissive approaches.

Greenside School was newly established and the staff had been involved in professional learning that focused explicitly on teaching the curriculum in an Innovative Learning Environment. At department level, discussions centred initially on past professional experiences and the enactment of present or future projects. All teachers in Greenside School were expected to use digital tools to enable students' learning. In both contexts, there was discussion about the content and context in which the learning would be taught.

5.5.3.1.1 Historically accumulated tensions

Of interest in this research was whether the historical roots of technology education, specifically its technical beginning, continued to drive the nature of the subject. Also pertinent was whether the age and nature of the school had affected the teachers' practice (Lakeside Academy had been established the early 1960's and Greenhill School had opened in 2016).

In Table 15, the local factors peculiar to each institution are outlined. These will be discussed in Chapter six in relation to how they enabled or limited each teacher's practice.

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Table 15. The local factors affecting each school context

Lakeside Academy	Bernadette's national reputation for technology education and recent appointment as head of faculty
(S1)	A professional learning focus on the <i>Nature of Technology</i> strand. An expectation that students produce quality outcomes Mike's view that his colleagues did not understand the role of digital technology Hospitality was the only senior secondary pathway for students to work with food as a material Students' expectations about the nature of the subject.
Greenhill School	Community understanding and students' expectations about the nature of technology education
(S2)	Alice's expectation that students need to produce quality outcomes The establishment, organisation, and access to specialist rooms An integrated curriculum.

Common to both schools was the expectation from the department leaders that students should produce quality outcomes, which could then be sent home for parents to be made aware about the nature of their child's learning. Colette reflected upon this notion during her final interview (at Greenhill School), stating

I think [teachers] are working under the perception, whether real or imagined... because I've been told that if it's not good enough, it doesn't leave here and you go, "Well if it's the kids work, it's leaving here".

I think that is a big part of why [the *Nature of Technology* strand is] not taught [is because] it delves more into the science and the history end of things and technology teachers do not traditionally have that background, you know, they're tradesmen who become teachers and they're quite good at the trade but again for the most part, they're tradesmen... (Final Interview A, Line 173)

Colette also described her impressions after working at Lakeside Academy, indicating that

I don't think it's unique to one school. I don't have a lot of experience across the board but the observation that I have of technology [education] is it's more about people's egos and them looking successful in the eyes of each other, and one upping each other...

[Students] make their mistakes, they do the things that kids do and then [teachers] go away and fix it all or they'll say, that part is not right, so bin it and you're going to make that over again or I've made it over again, so they'll put it into your project. (Final Interview A, Line 105)

Colette also reflected that

My introduction to the New Zealand curriculum was that it was like trying to understand the Trinity, in other words, you could talk about it and people go, “It’s a mystery”.

To me it’s a very simple document and its not very prescriptive either so it gives a tremendous latitude to the teacher to do stuff, which I think it needs to be if you’re going to be innovative and creative and do those things...

I think there is a lot of fear of failure, ultimately feeling like you’re going to be measured by what your kids produce or don’t produce and so everything is geared to that. (Final Interview A, Line 237)

5.5.3.2 Mediated artefacts

Mediated artefacts relate to the conceptual and physical resources that represent teachers’ learning processes. In Lakeside Academy, this was evident through the provision of worksheets, as developed by Bernadette, to be adapted by each teacher for their specialist area of technology education. In Greenhill School, discussions during department meetings served as a means to generate data about teachers’ conceptual understanding of the technology curriculum (MoE, 2007). The equipment available for use during the teaching of technology education also led to insight about teachers’ perceptions about the purpose of technology education. In Lakeside Academy, traditional equipment (such as lathes), were available to enable students’ technological practice. During Bernadette’s lesson, some students also used desktop computers for their design tasks. In Greenside School, there was an expectation that students used their laptops (in the place of books) and there was similar equipment to Lakeside Academy, as well as some CAD/CAM equipment (like 3-D printers).

5.5.3.3 Subjects

Whilst all participants described themselves as teachers of technology, they all had different backgrounds, experiences, and ways of viewing the subject. Bernadette (S1) described herself as a hard materials teacher. Alice (S2) was a product design specialist, Mike (S1) a digital technology teacher, and Helen (S1) and Graham (S2) stated they were food technology teachers. Colette was described as a hard materials teacher in Lakeside Academy and then a product design teacher in Greenhill School. Interestingly, none described themselves

technology teachers before identifying their specialist area. Whilst the professional learning at Lakeside Academy did focus on curriculum concepts (MoE, 2007), discussions were based upon what that might *look like* in a specialist area of technology. In Greenhill School, the discussions centred on the anticipated learning opportunities, from an integrated and project based perspective, and as determined in negotiation with the Co-teachers.

5.5.3.4 *Objects*

The technology curriculum (MoE, 2007) and professional learning aims were objects of focus. The collective goals of the two schools were mediated differently. In Lakeside Academy, Bernadette was focusing on the *Nature of Technology* strand because she was aware that it included concepts with which her colleagues were least familiar. She shared her expertise with colleagues for them to better understand the curriculum (MoE, 2007) for them to then make meaning of the content for their own specialist learning context. In Greenhill School, technology education was being established with the assumption that specialist teachers had the capacity to interpret technological concepts for their own practice.

Tensions emerged when the school's or department leader's vision did not align with practitioners' perceived role as technology teachers. For example, when Colette was working at Lakeside Academy, she expressed concerns about the way that her area of technology (wood) was perceived and marginalised by Bernadette. Helen too felt that she was not in a position to enable significant change because of the existing Hospitality pathway in the senior school, which was the only option for students interested in working with food as a material.

5.5.3.5 *Rules and distribution of labour*

In Lakeside Academy, there was a hierarchical approach towards teaching - both during the lesson observations and department meetings. In contrast, teachers' practice in Greenhill School was determined by the integrated and learner-centred approaches to curriculum.

5.5.3.5.1 *Organisational structures*

In Lakeside Academy, students experienced technology on a rotational basis in Year 9 and then opted for two technology subjects in Year 10, equating to six months each. In Years 11 to 13, there were both generic technology and vocational pathways available for students. Mike indicated that when he taught Year 9 students, he did not identify their prior knowledge or differentiate the learning - he taught a programme that supported students towards the senior secondary pathway in digital technology, focusing on the *Technological Practice* strand.

In contrast at Greenhill School, technology teachers worked as part of a team of teachers to deliver an integrated curriculum to students in Years 7 to 10. During the data collection phase, the senior high school was being built. Participants indicated that much of their time in Greenhill School was spent establishing the place of technology in the curriculum and providing professional learning for colleagues who did not understand the contemporary purpose of the subject.

At Lakeside Academy, Bernadette emphasised her knowledge of technology education (as it is conceived in the curriculum) (MoE, 2007) in order to position herself as the expert; she also did so when leading the department in professional learning. Conversely, at Greenhill School, Alice and Graham were leaders of their specialist learning areas of product design and food technology, but there was a common understanding of the vision for learning because all teachers had been exposed to recent professional learning to enable a focus on concepts from the curriculum (MoE, 2007). There was evident tension about the fact that non-specialists were being encouraged by the senior management to teach technology education.

All observed lessons began with an introduction to the learning focus and included teacher-led discussions. There was a differing emphasis on classroom routine and expectations, as determined by the time of year that the lesson was taught, year level, needs of learners, and nature of the lesson (theory or practically based). All teachers acknowledged the need to adhere to the curriculum (MoE, 2007) but did so, with differing effect.

5.5.3.6 Community

Figure 24 highlights that at Lakeside Academy there was the provision for both trades and generic technology education pathways in the senior secondary school, which affected the teaching that occurred in the junior school programmes. The options available in each of the specialist areas differed with Bernadette and Mike offering University Approved pathways, and Colette and Helen providing Trades based programmes. In Greenhill School (a junior high school- the senior high was being built) Graham stated

The whole philosophy of our school is a “love to learn” and if the students have the language and the literacy within technology and they have learnt Brief Development and it’s the only thing that they’ve done until they get to Level 1 [NCEA], but in depth, it’ll be fine. (Final Interview F, Line 148)

There were evident differences between the schools in terms of the ways that teachers’ thought that they should prepare students for the senior secondary environment. There were expectations from both school communities that students should be doing practical work when their learning focused on technology education.

5.5.3.7 Outcome

Figure 24 also highlights the emerging tensions that resulted from the circumstances in both school contexts. In both schools, there were tensions between teachers’ perceptions and practice, the way that they were able to make meaning of the curriculum, choose and use deliberate strategies for teaching technology education, and enact curriculum concepts (MoE, 2007). Despite teachers’ espoused views, they were interpreting the curriculum from a lens of the *Technological Practice* strand and appeared hesitant to engage with the *Nature of Technology* strand (despite the professional learning focus in Lakeside Academy) (MoE, 2007). There were some evident tensions between the ways that teachers navigated curriculum theory and practice, as highlighted through the knowledge that they found troublesome.

5.5.3.8 Contradictions

The school’s organisational structures and teachers’ perceptions about the purpose of technology education led to contradictions in the ways that the three strands of

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Technological Knowledge, Technological Practice and the Nature of Technology were perceived, interpreted, and enacted. These factors are discussed in the next section in reference to the hierarchical levels, identified in Figure 24.

5.5.3.8.1 Primary level contradictions

Primary level contradictions occur within the elements (such as the distribution of labour), and explanations can be connected to the influence of political agenda (Engeström, 1987). Figure 24 highlights that the elements of objects and rules indicated primary level contradictions. There were evident tensions between teachers' perceptions of the nature of technology and the need for them to interpret and adhere to a curriculum (MoE, 2007) that was not well understood. The objects used to support teachers during school-based professional learning either focused on best practice (Lakeside Academy), made assumptions about teachers' understandings (Both schools), or did not directly connect to the curriculum in a deliberate manner (Greenhill School - in practice). The rules imposed by each school, such as the curriculum structures and community expectations affected teachers' practice.

5.5.3.8.2 Secondary level contradictions

Secondary level contradictions can occur between the elements to explain the factors affecting a teacher's practice (Engeström, 1987). In Lakeside Academy there were tensions between the rules-tools and signs-object, subject-rules-division of labour, and division of labour, rules and object elements. Bernadette was establishing her role as the head of faculty and was keen to consolidate shared understandings of the curriculum (MoE, 2007) in her department. She wanted to maximise the time available to do this during department meetings and adopted a transmissive style that was efficient and enabled the sharing of her expertise. Bernadette and Mike had differing views on the way that the curriculum (MoE, 2007) might be taught. Bernadette encouraged staff to replicate her approach by adapting her teacher-generated resources. In Greenhill School, the influence of the subject-community-objective elements was evident during the department meetings. Specifically, the relationships became evident when teachers were discussing the challenges when ensuring that the "essence" of technology

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education was maintained within an integrated curriculum, and a newly established Innovative Learning Environment.

5.5.3.8.3 *Tertiary level contradictions*

Tertiary level contradictions can signal tensions in a phenomenon and support recommendations for change (Engeström, 1987). The key tensions, as highlighted in Figure 24 related to

- Teachers' attitudes about developing students' practical skills, for the realisation of quality outcomes
- The propensity for teachers to make decisions about the nature of learning, without consultation with students
- The emphasis on the *Technological Practice* strand of the curriculum and apparent hesitance to engage with the *Nature of Technology* and *Technological Knowledge* strands (MoE, 2007)
- The differing levels of teacher engagement with the curriculum (MoE, 2007), in relation to its interpretation
- The need for teachers to navigate disparity between curriculum theory and practice.

5.5.3.8.4 *Quaternary level contradictions*

The quaternary level highlights commonalities - in this case between two school systems (Engeström, 1987). There was evidence that in both junior school contexts

- There was a disparity between teachers' espoused perceptions and practice
- There were differing ways of thinking and attitudes towards technology education, as the result of teachers' previous professional experiences
- Teachers' capacity to make meaning of the curriculum (MoE, 2007) determined whether they felt empowered to take pedagogical risks, replicate, or retreat to previously established practice

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- Teachers made decisions about the learning context, without consulting students until there were indications that learners were disengaging,
- Teachers emphasised the development of practical skills with the view to manufacture high quality products, and to accommodate community expectations,
- Curriculum structures were impacting on students' experiences of technology education.

5.6 Chapter summary

This chapter presents the findings regarding the six teachers perceptions of technology education, as identified during their interviews, in lesson and department meetings and through their teacher-generated resources. The way in which professional learning was mediated in each school, as well as the factors influencing practice are identified to describe the nature of technology education in both schools. The next chapter discusses the key findings, which include the tensions between technical and technological perceptions, consequent engagement with the curriculum (MoE, 2007), the way that learning is organised, and the persisting influence of community understanding on the nature of technology education.

CHAPTER SIX: DISCUSSION AND IMPLICATIONS

6.1 Introduction

This research explored how teachers' perceptions influenced their engagement with and enactment of technology education, with a view to determine how a disparity between curriculum theory and practice could be mediated. This chapter discusses the findings presented in Chapter five, which highlight the factors affecting the six participant teachers' engagement with the technology curriculum (MoE, 2007). It discusses teachers' espoused perceptions and practices in two secondary school contexts and considers the view that technology education is influenced by practical, knowledge-based, and organisational factors (Pacey, 2001; Williamson, 2013).

The first section focuses on teachers' perceptions that technology education should emphasise the production of quality outcomes and the view that there is a need to teach students knowledge in a pre-determined and teacher-driven manner. It discusses teachers' motivation to engage with and interpret the curriculum (MoE, 2007) and embrace new pedagogies (Grundy, 1987; Grundy & Robison, 2004). The interpretation of the curriculum (MoE, 2007) is conceptualised in reference to teachers' stated understandings of its intent, specialised areas of technology, or perceived responsibility to enact it in their school.

The following section considers how teachers' enacted the curriculum (MoE, 2007), and the focus on the *Technological Practice* strand (Apple, 1998; Giroux, 1983; Giroux & McLaren, 1986; Pinar & Bowers 1992; Pinar, et al., 1995). There is discussion about teachers' apparent hesitation to engage with the *Nature of Technology* strand and the perception that there are insufficient professional learning opportunities to enable meaningful knowledge for practice (de Vries, 2005; Fox-Turnbull & Sullivan, 2013). The discussion then focuses on school-based professional learning, contrasting approaches and implications for teachers' evolving understandings. Each teacher's circumstances are probed to illustrate the dominant discourses influencing their enactment of technology education and the impact of each socio-cultural context on their practices (McLaren, 1989).

How participants' knowledge for practice was affected by their attitudes towards teaching and ways of thinking about technology education is also highlighted. The

assumption that if a teacher has experience and knowledge of their specialist area of technology, they will be able to make meaning of the curriculum is challenged. Finally, the implications of teachers' perceptions and interpretation of the curriculum (MoE, 2007) are discussed in reference to their pedagogical practices. The notions of student-centred and self-regulated learning are also contextualised to discuss some of the issues facing technology education.

This chapter concludes with comparisons between the two school contexts to consider the influences of traditional and contemporary pedagogies on technology teachers' practice. The identified contradictions support the view that there is a continued need to focus on teachers' understanding of the curriculum (MoE, 2007; Williams, 2013). Finally, a proposed professional learning model in technology education is introduced.

6.2 Emerging themes

Participants' perceptions were mediated by a variety of factors at different stages of their pedagogical processes and the key themes are organised according to teachers' perceptions, interpretation and enactment of the curriculum (MoE, 2007) in Figure 25.

Perceptions	Interpretation	Enactment
<ul style="list-style-type: none"> •Content should be taught first, then applied through the development of practical outcomes. •Outcomes are to be replicated and based on existing outcomes. 	<ul style="list-style-type: none"> •Interpretation is based on teachers' understanding of the <i>Technological Practice</i> strand •There is some hesitation to engage with the <i>Nature of Technology Strand</i>. 	<ul style="list-style-type: none"> •Is teacher-centred •Is determined by the skills and knowledge to be developed, rather than learner-centred.

Figure 25. The key research findings according to the research questions

The participants' views emphasised a need to teach certain pre-determined skills to enable learning in their subject, which is reflective of the technical origins of the subject (Petrina, 1992). Participant teachers positioned the subject as being primarily about the development of competencies to enable the technical

replication and development of quality practical outcomes (Fraser, 2000; Gilbert, 2007; Zuga 1989). This was counter to a contemporary view that technology education can provide the opportunity to provide problem-solving activities, which encourage critical and creative thinking and develop technological literacy (Gilbert, 2007; Lewis, et al., 1998, Williams, 2015; Zuga, 1989).

Based on my classroom-based and leadership experience in secondary schools, I had assumed that specialist teachers of technology would be able to make connections between their specialist understanding, professional experiences, and the technological concepts in the curriculum (MoE, 2007). However, it appears that specialist knowledge (of carpentry, for example) does not necessarily equate to an ability to interpret the technological concepts in the curriculum for a teacher's practice. The ways that the curriculum is interpreted and enacted by teachers is discussed, in reference to the disparity that exists between curriculum theory and practice. In particular, the findings indicate that teachers were emphasising the *Technological Practice* strand, and there was a hesitance to make meaning of the *Technological Knowledge* and *Nature of Technology* strands (de Vries, 2005; Fox-Turnbull & Sullivan, 2013).

The research findings confirmed that there was a disparity between teachers' future-focused perceptions of the nature of technology education and their practice. Whilst importance might be placed internationally on the development of technologically literate citizens (Williams, 2013), this research suggests other areas of emphasis in New Zealand secondary schools. The observed practice was teacher-centred in nature, and the context for learning was derived from teachers' specialist understandings rather than from the technological concepts and philosophy underpinning the New Zealand curriculum (MoE, 2007).

6.3 Teacher perceptions

The baseline interviews indicated both consistencies and contradictions in teachers' perceptions of technology education and their subsequent practice within the secondary school context. There were clear associations between teachers' perceived role of how technology education could develop skills in citizenship, occupational preparedness, or foster students' personal growth (Adler, 1982). Helen's data for example, highlighted her view was that she was required to moderate her teaching of the technology curriculum because her primary role

CHAPTER SIX: Discussion and Implications

was to prepare students for their potential senior secondary pathway in Hospitality. The interview data suggested that Helen understood her responsibility to enact the professional learning to which she was exposed but she did not appear to have sufficient confidence to change her programme or make independent meaning of the curriculum to develop her knowledge for practice. Helen espoused an interest in teaching the technology curriculum but relied on others' guidance to do so. She appeared to lack the motivation to change her practice, which remained historically and culturally located (Handal & Herrington, 2003; Ryan, 1984; Paechter, 1995). This was exemplified through the design of her junior school programme, which was based on content derived from the home economics discipline, rather than technology education (See Section 5.3.5).

All participants in this research signalled an interest in developing their professional practice, although not all demonstrated an understanding of how they could implement change. The professional goals that teachers identified were aligned with each school's learning foci as well as their own personally identified areas for development. All of the participants were motivated by the need to change others' outdated perceptions of the nature of technology education. Five of the participants identified an interest (but hesitation) in taking pedagogical risks to improve their curriculum-based practice. This indicated potential for technology teachers who are motivated to engage in professional learning to support the development of practices that are reflective of current pedagogical thinking (Saxton et al., 2014).

Participants in this research (with the exception of Helen) acknowledged that technology education provides the opportunity to foster a learning environment that encourages problem solving and the development of innovative outcomes in an authentic context (Newmann & Wehlage, 1993; Oblinger, 2007; Osborne, 2016; Snape & Fox-Turnbull, 2013; Splitter, 2009; Turnbull, 2002; Zuga, 1989). The pervasive emphasis (with the exception of Bernadette) on the development of practical skills and replicated products contradicted this view however. Teachers' practice was affected by their understanding of the curriculum, subject leadership, and school structures.

For Alice and Graham, whose espoused views aligned with a contemporary view of technology education, the reality of a newly established school and the need to

foster collegial relationships limited their ability to teach within an authentic or future-focused context. In both instances, Alice and Graham reverted to traditionally placed pedagogies where students were told what and how an outcome was to be replicated. Such practice positioned technology education as being craft-based in nature (Hill, 2003), leading to insights about why these teachers valued their specialist knowledge (Mutch, 2003; Zuga, 1989). In this case, a failed attempt at realising the curriculum in a contemporary manner made teachers hesitant to persist with new approaches (Greenberg & Baron, 2000); instead they maintained the status quo (Boyatzis, et al., 2002; Fullan, 2002).

6.3.1 The nature of Technological Knowledge

The participants held differing views about the nature and timing of technological knowledge when facilitating student learning in the subject. The findings indicate that it is the teachers who determine what is important for students to know in technology. The *Technological Knowledge* strand is defined as being about the

...Key concepts that underpin all technological development and the resulting technological outcomes.

By exploring functional modelling, students learn to compare simulated representations of reality to the reality itself and come to appreciate the power and limitations of functional modelling.

By exploring prototyping, students come to understand its importance and how they can use it to advantage in their own technological practice. By gaining knowledge of materials used in technological products and of components and connections used in systems, students can bring greater understanding to their own technological practice and decision-making. (Technology Online, 2010c)

Appropriately learning was often centred on the knowledge underpinning the development of practical outcomes. The nature of those outcomes however, were generally predetermined by the teacher and limited the opportunities for students to develop their decision-making skills or to engage in innovative thinking or practices because decisions were made *for* rather than *with* the students. This was indicative that teachers' understanding of student-centred classrooms was still evolving and that approaches to learning remained traditional in nature.

The use of CAD/CAM in technology classrooms is becoming more common in New Zealand and is designated here as being a future-focused practice, necessary to the contemporary teaching of technology education (Education Gazette, 2017;

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Jones, 1997; Xu & Duhovic, 2004). Exposure to such learning is particularly pertinent with the recent emphasis on digital technology in the curriculum (Bates, 2001; MoE, 2017b; Steeples, et al., 2002; Welsh, et al., 2003). During her interview, Alice expressed concerns about the use of CAD/CAM in technology education. Whilst she could appreciate the benefits for students' learning, she was also hesitant about its overuse because she valued the development of manual skills. This attitude provides insight into why, despite access to appropriate resourcing, technology education might not have evolved to embrace a future-focused approach, which is inclusive of digital approaches (Williams, et al., 2015; Wright & Forbes, 2015). Rather than negotiating with students about what they could make - to encourage student agency (Beane, 1997), there was a common view from participant teachers that they should make decisions about the type of products to be developed.

Colette suggested that this discourse could be explained by a triadic relationship that included knowledge, skills and the technological learning context. She asserted that the relationship correlated with students' success in technology education, indicating

...If they don't have knowledge, they can't apply the skills if they don't have an understanding of the nature of things or a context. Conversely, if they have context but they have no way of applying it practically with a skill then it's lost as well. (Baseline Interview A, Line 185)

This perceived relationship provides some insight to teachers' preoccupation with quality outcomes and the consequent view that there is a need to develop students' practical skills to enable successful learning in technology. Equally, it suggests that some teachers are not fully engaging with all curriculum concepts to consider how the *Nature of Technology* and *Technological Knowledge* strands inform students' learning (Compton & Jones 2004; de Vries, 2005; MoE, 2007; Packer & Goicoechea, 2000; Perkins, 1999). The findings indicate that teachers continue to emphasise the *Technological Practice* strand predominately because of its potential to engage students in their learning but also because it represents curriculum content that is familiar to them as practitioners, but also their community. This is an interesting finding because Alice, Colette, and Graham all asserted that the three strands should be given equal weighting or be taught in a naturally occurring manner.

6.3.2 The nature of Technological Practice

All of the teachers acknowledged the role of the *Technological Practice* strand as a means to engage learners, specifically because of its kinaesthetic nature. *Technological Practice* is defined in the curriculum as providing an opportunity to

...Develop a range of outcomes, including concepts, plans, briefs, technological models, and fully realised products or systems.

Students investigate issues and existing outcomes and use the understandings gained, together with design principles and approaches, to inform their own practice. (MoE, 2007, p. 32)

The research findings identified that five of the six teachers had a well-established understanding of the *Technological Practice* strand, but even amongst the six participants there was disparity about how the concepts could enable the development of outcomes. Colette suggested that in her view, technology teachers were heavily influenced by their position in the community. Accordingly, the resulting technological practice was centred upon production of quality outcomes with a view to maintain teachers' professional identity. Her observations indicated a view of technology that was traditional in nature and focused on the replication of existing outcomes. This is contrary to the view that technology education should enable learning that accommodates the development of unique outcomes in response to identified needs or opportunities.

Bernadette identified a necessary focus on practical work but suggested that students' learning should be inclusive of the knowledge underpinning a product's development. It is interesting however that when she described how the work was sent home to parents the manufactured outcomes were presented at the front of students' portfolios. This suggested that there was more value placed on the realisation of the outcome rather than the thinking that informed the technological process. Bernadette asserted that in her classroom the outcomes were not generally pre-determined. Contrary to this attitude however, she described her idea for a project focusing on Sunglasses. In this instance, Bernadette had decided that the learning would emphasise testing, prototyping, and experiential learning. She explained that to enable such learning, she would "get some old [sunglasses], pull the lens out and make new frames, [then] 3-D print them" (Final Interview B, Line 259). In this learning context, students would be engaging in technological

practice to primarily foster deeper understanding of the *Technological Knowledge* and *Nature of Technology* strands, specifically the historical development of a product and the reasons why it has developed to respond to a societal need (Allen, et al., 2016).

These findings substantiate that teachers consider the *Technological Practice* strand as a means to engage students in learning and that this approach can incorporate problem-solving, creative, and innovative thinking. During the observed lessons five of the six practitioners were limiting students' practice to enable the replication of existing outcomes and using the learning as a means to develop practical skills. Teachers who advocate for such an approach are likely to default to the types of projects that they have taught in the past (Apple, 2006). This mirrors the international trends that have influenced curriculum development (Jones & Compton, 2009) and in particular Barlex's observations (2016) that in the United Kingdom students in Design and Technology were often doing the same projects that their parents did. An emphasis on the development of practical skills aligns with de Vrie's (2009) view that technology teachers have found a change in thinking conceptually challenging because they are "practical people who like to do practical things in class" (p. 15). This highlights a tension between teachers' perceptions of the nature of technology education and their interpretation of the curriculum (Jones, 1997), which is discussed in the next section.

6.4 Curriculum interpretation

When describing their professional roles, all teachers acknowledged that their practice needed to be continually evolving. All participants suggested that this could be achieved through continued engagement with and interpretation of the curriculum. Only Graham made reference to the importance of understanding the curriculum with a view to inform pedagogical responses, which could address students' learning needs. Alice, Colette, Graham, and Mike described technology education as a subject that could be learner-centred, responsive, and empowering in nature. All but Helen identified the need to have specialised knowledge as well as understanding of the intent of the curriculum. Bernadette acknowledged the need to understand the technological concepts (Achievement Objectives) as they

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are presented within the curriculum (MoE, 2007) but did not discuss how that might translate into her classroom practice.

During classroom observations, teachers engaged less with the *Nature of Technology* strand of the curriculum, suggestive of a continued need for teachers to develop their professional understandings of this strand to accommodate the complexity of teaching within the discipline of technology education (Jones, 2009; MoE, 2007; Williams, 2013; Williams & Lockley, 2012). This is particularly pertinent where teachers' professional learning needs are not being addressed (Borko, 2004; McDiarmid & Corcoran, 2000). To engage fully with the technology curriculum there is a need for teachers to understand and incorporate all three strands rather than approaching it primarily through the lens of *Technological Practice* strand, as the research findings indicate.

Helen's interview and classroom observation suggested limited engagement and understanding of the technological concepts in the curriculum (MoE, 2007). She associated work plans and food orders with the curriculum concepts but could not articulate where or at what achievement level. Helen's judgment around the appropriateness of tasks or the establishment of a classroom culture appeared to be based upon habit (Määttänen, 2015) - specifically her teaching of Home Economics in South Africa - rather than on meaningful interpretation or engagement with the New Zealand curriculum (MoE, 2007). This finding aligns with Handal and Herrington's (2003) research, which asserted that when practitioners lack confidence in terms of content knowledge or are resistant to a change in thinking, their practice might default to their own beliefs rather than current professional practice.

For the participants in this research, their understanding of the curriculum was closely associated with their specialist area of technology, which is pertinent in light of the recent changes to the technology curriculum where the position of digital technology has been emphasised (MoE, 2017b). Mike's interview highlighted other digital teachers' attitudes towards their place in the technology curriculum and suggested concerns about the need for them to refine their practice to align with the technological concepts. Further discussions about this are outside of the aim of this research.

There appears to be a tension for teachers who prioritise their specialist understandings over the technological knowledge required to make meaning of the concepts within the curriculum. It is evident that for teachers (like Helen), that to make meaning of the curriculum there needs to be sustained engagement with theoretical concepts (Hipkins, Cowie, Boyd, Keown, & McGee, 2011; Williams, 2013). It can be challenging if a practitioner is working in isolation or if they lack the understanding or confidence to take risks in their teaching. There was a paucity of literature to support the notion that the meaning making of technological concepts for differing specialist areas of technology might be a barrier to the subject's enactment. As discussed earlier however, opposing forces in meaning and meaning making are likely to either unite or destabilise teacher understandings, which in turn can lead to a consolidation of thought or alternatively, a resistance to conditioning (Mortimer & Scott, 2003). It is asserted that understandings of the technological concepts in the curriculum are distinct to a professional's specialist knowledge and are not necessarily transferrable in nature.

6.5 Curriculum enactment

The findings suggest that participants' practice did not appear to use a range of differing pedagogical practices or regularly include authentic (real-world) learning opportunities. Bernadette had however, developed two pathways for learning in her classroom, which could be considered innovative teaching because she was offering personalised programmes (OECD, 2014). Five of the six teachers espoused the importance of a range of pedagogical approaches but appeared to experience difficulty when translating the theory into practice (Williamson & Blackburn, 2016). As a result technology education was positioned as being practical in nature and thus centred on a process-driven and practice-based approach to its enactment, reflective of the emphasis on the *Technological Practice* strand. The concern with this approach is that it limits the opportunities to develop students' technological literacy (Adler, 1982). Technological literacy is demonstrated when students have a broad understanding of the ways that made products work or are developed as a result of societal intervention, needs, or opportunities (Technology Online, 2010).

6.5.1 Hesitance to engage with the Nature of Technology strand

The research findings indicate that there was some hesitance to engage with the concepts from the *Nature of Technology* strand and a lack of insight into the alternatives to a process-driven approach to the technology curriculum. For example, Bernadette acknowledged that her interest in the *Nature of Technology* strand was a fairly recent phenomenon and that her practice continued to be driven by the *Technological Practice* strand. Alice, Bernadette, Colette, Graham, and Mike could all describe the general philosophy of the differing strands, but these concepts were not observed in their classroom practice. These teachers relied heavily upon their previous experience and specialist knowledge to enact (or not) the curriculum concepts (MoE, 2007). According to Graham, engagement with all three strands did not necessarily reflect a lack of teacher understanding but instead indicated a response to workload constraints.

Graham positioned the *Nature of Technology* strand as the means to contextualise technological practice rather than as distinct learning that could inform students' technological literacy (Jones & Compton, 2009; Rose, 2007). This is key to teachers' understanding of the intent of the technology curriculum because it reflects thinking that might de-emphasise the relationship between technology and society. Such a focus is likely to be to the detriment of learning about the *Technological Knowledge* and *Nature of Technology* strands, and is contrary to the intent that technology should be about "the ability to use, manage, assess and understand technology" (ITEA, 2000, p. 9). There are limitations associated with an approach to technology education that excludes a focus on ways that technology is responsive to and shaped by societal need (ITEA, 2007). There are also opportunities for teachers to enable learning opportunities through craft-based activities, industry, science, hi-tech, key competencies or design contexts, in a range of authentic contexts. Such opportunities are likely to ensure that students' understandings of technology education can evolve as a result of their interests.

6.5.2 Professional responsibilities

All participants acknowledged that it was their role to understand the curriculum to fulfil their responsibility by engaging with professional learning and maintaining currency in the educational context (MoE, 2007; NZEC, 2017). The

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technology teachers represented their professional responsibilities in differing ways and all but Helen articulated the benefits of teaching technology education. Such differing responses aligned with perspectives presented in the literature to indicate that technology teachers can present progressive, regressive, or indifferent views about technology education (Jones, et al., 2003; Mansell, et al., 2001). There was evidence to suggest that teachers' self-concept and professional identity affected their professional practice (Biggs, 2006; Dakers, 2006, de Vries, 2005; Fox-Turnbull & Sullivan, 2013), but this was predominately the result of a sense of belonging within their specialist area of technology rather than because of an association with technology education.

An enduring expectation in the New Zealand secondary school context is that teachers should be responsive to adolescents' academic and social needs and encourage a sense of safety and belonging (Bandura, 1982; Covington, 1984; NZEC, 2011; Parsons & Taylor, 2011; Schunk, 1985). All teachers made decisions about classroom-based learning according to what was manageable for them; they all considered what might be of interest to their learners when they were planning their teaching but did not negotiate the learning context with students prior to its enactment (Hill, 2003; Reinsfield, 2014).

Alice's and Graham's data reflected a common theme in the research - teachers' actions had a tendency to focus on rules, project planning and classroom management at the beginning of the year - rather than emphasising learning about the technological concepts within the curriculum (MoE, 2007). According to Alice, such a focus was necessary to accommodate her students' learning needs. When technology teachers are expected to teach in a manner that is different to their usual practice, tensions can manifest between their professional identity and professional practice (Biggs, 2006; Dakers, 2006; de Vries, 2005; Fox-Turnbull & Sullivan, 2013; Hoyle, 2008).

In Greenhill School for example, if a project did not appear to be meeting students' needs, it was discontinued. In these circumstances both Alice and Graham defaulted to the replication of practical outcomes of high quality - demonstrative of a traditional approach to technology education. For Alice and Graham, this was a deliberate approach to counter underachievement (Cubitt, 2006). The risk with such an approach is that there may be immediate

improvements (in terms of behaviour) but limited change to students' conceptual understanding of technology education or their attitudes towards learning in this subject.

The key findings indicate various factors mediating a technology teacher's practice, regardless of whether they are situated within a traditional or innovative learning context. It is important to note here that whilst some participants espoused a preference for learner-centred approaches based upon students' interests, where pedagogy was critical and authentic in nature, only Bernadette appeared to reflect aspects of a future-focused approach to learning in technology (Brough, 2008; Hill, 2003; Onchwari, et al., 2009; McCombs & Whisler, 1997; MoE, 2007). Bernadette modelled responsive practices whilst also addressing the curriculum concepts (Archambault, 1974; Cook-Sather, 2002; Duckworth, 1987; Lebow, 1993; MoE, 2007). The following section discusses the emerging themes in more detail.

6.5.2.1 Lakeside Academy

Bernadette's practice reflected the accommodation of future-focused projects during the observed lesson. She was responsive to students' academic learning needs but promoted a traditional teacher-student relationship in her classroom. Bernadette engaged in dialogue with her students to negotiate their learning outcomes but had a very clear learning goal in mind, reflective of her years of teaching experience. Her practice appeared to be informed by a holistic understanding of the nature of technology education, which had been adapted to align with the traditional school context (Carrington & Robinson, 2006; Kanjanabootra & Corbitt, 2016; Korthagen, Kessels, Koster, Lagerwerf & Wubbels, 2001; Loughran & Berry, 2005).

Also in Lakeside Academy, Mike was experiencing some challenges when enacting technology education in the senior secondary school. He suggested that he had not used sufficiently rigorous processes to evidence students' (NCEA) academic work in digital technology. Mike demonstrated a reflective approach to his teaching and felt supported to take pedagogical risks, acknowledging the support that he had received from Bernadette to develop his contemporary approaches towards curriculum enactment.

6.5.2.2 Greenhill School

In contrast, the teachers at Greenhill School were situated within an Innovative Learning Environment, which according to Osborne (2016) should make the enactment of future-focused practices easier to realise. Noteworthy however, the findings do not align with such a view. Alice, Colette, and Graham had access to modern resources and were encouraged to use digital technologies as a means to facilitate learning. They were delivering technology education through an integrated curriculum, in collaborative teams, and for longer periods of time than a traditional timetable would be able to accommodate. The practice that resulted was constrained (during the data collection phase) by unreliable Internet access, an unavailable workshop, and the need to support other colleagues' evolving understandings of the subject. Whilst the situated environment was indeed comfortable and aesthetically modern, the rooms were often accommodating several groups of students, all of whom were working on and transitioning to different activities throughout the learning block. The noise was problematic for Alice during her lesson. The potential for innovation thus appeared to be moderated by the practicalities of teachers' spaces, the organisation of learning activities, and the administrative structures within the new school context.

As a Chef, it might be assumed that Graham would be more likely to adopt a technical approach to technology education, but instead he asserted that his practice was motivated by student interest and the technological concepts as they were presented in the curriculum (MoE, 2007). During his final interview, Graham discussed the need to change the learning project about Food Trends. He explained that there was minimal student interest and consequently he and his co-teachers collaborated to enter a competition and re-invigorate students' motivation for their learning (Wilson & Ingram, 2009). The learning focus changed from a context that highlighted the *Nature of Technology* strand to a project based on the replication of existing dishes using Maggi sauce sachets. Graham could have used this learning context as a means to investigate why Maggi sachets had developed (to respond to a societal need) and consequently maintained the focus of the *Nature of Technology* strand. Instead, students developed a range of meals using the Maggi packets as the base of a sauce. This appeared to contradict Graham's

espoused view that curriculum concepts should be taught in a naturally occurring manner and likely reflects the external pressures affecting his practice at the time.

It would appear that in this context, the need to accommodate responsive pedagogies might have constrained Graham's planning and enactment, placing him in a position where the students' learning became technical in nature. This finding also mirrors some of the themes within the literature to indicate that for contemporary pedagogies to be successful, students need to be actively involved and motivated to engage with their learning (Dowden, 2006; Etim, 2005; Fraser, 2000).

It appeared that in Greenhill School, despite the opportunity to enact contemporary approaches to education and teachers' perception that teaching should be learner-centred, this did not always translate into pedagogical practice. Equally, adherence to the curriculum was limited in both schools by the circumstances that were encountered. The research findings indicated technology teachers' starting point for the enactment of technology education was their specialist area of technology, rather than the technological concepts as outlined in the curriculum (MoE, 2007). This provided new insight into teachers' approaches and understanding of the curriculum.

The next section of this chapter discusses the commonalities and contradictions between the two school contexts with a view to explore how they can represent the nature of technology education.

6.6 The implications

The purpose of identifying contradictions and commonalities is to determine some of the historically accumulated tensions in technology education, with a view to propose strategies that can assist teachers to navigate these tensions and transform their practice (Engeström, 2001). By comparing networks of interacting activity systems, multivoicedness was explored and tensions identified to represent the differing interpretations of the nature of technology education (Gee & Green, 1998). The factors in each school represented common themes despite the fact that Greenhill School was newly established and an Innovative Learning Environment. These commonalities included teachers' identities and the challenges they faced when making meaning of the curriculum concepts for their

own specialist area. In both schools community expectations were used to rationalise the emphasis on the *Technological Practice* strand, and there was some hesitance to engage with the *Nature of Technology* strand of the curriculum (MoE, 2007). This suggests that these views are considered to be legitimate concerns about how the technology curriculum can be interpreted and enacted (Meyer & Land, 2003; Williamson, 2013), as discussed in the next section.

6.6.1.1 Community expectations

Technology education has the potential to engage students in authentic learning, which can make a difference to their school and local community and can foster understandings about the way that technology interacts with the wider society to generate understanding of future-focused issues. However, this research suggests that for the participants involved, there were enduring and outdated understandings about the purpose of technology education in their school community, and these alternate views influenced their practice. There were implications for motivated teachers because collegial, parental, and students' understandings had to be navigated with a view to enact technology education, as it is conceptualised in the curriculum (MoE, 2007).

Bernadette and Graham indicated that they felt empowered to challenge others' perceptions, perhaps because they were in leadership roles. They did so by correcting the language used to describe the subject or by explaining the way the subject was enacted in the classroom (to parents). The risk with this approach however, is that if teachers challenge the way that their subject is described only in these circumstances, a change in thinking is likely to be limited to opportune discussions. Equally, if teachers do not fully understand the subject themselves, cannot articulate its nature, or focus only on one aspect (such as *Technological Practice*), misconceptions are likely to be perpetuated (Biggs, 2006).

Community perceptions about the purpose of the subject appeared to be based on personal experiences. At Greenhill School, there was an opportunity for teachers to position the subject in a manner that they perceived to be representative of its "Essence" within the integrated curriculum and across learning areas (Stoll, et al., 2012). Alice had indicated that this requirement meant that teachers in the school

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were employed as a result of both their expertise but also their espoused interest in contemporary pedagogies.

It could be assumed that in a school where teachers are chosen for their expertise and philosophical attitudes towards contemporary pedagogies, that participants would feel empowered to interpret and enact the technology curriculum. There were concerns expressed however about the general staff attitudes towards the subject's enactment. It appeared that at Greenhill School, the nature of the integrated curriculum presented an opportunity for any qualified teacher to manage a group of students in any learning context. From one perspective, this could suggest a changing collegial attitude towards the role of technology education, but equally it could minimise the subject's specialised nature. To manage this, Alice articulated an intention to expose her Co-teachers to the technical nature of the subject, to develop their understandings of the properties of materials and provide insight into the health and safety requirements in the workshop. She did not have solutions to how she could support the development of teachers' pedagogical knowledge to enable the successful management of large cohorts of students within a practical environment and to ensure their physical safety. In this circumstance, there were opportunities to raise both the profile and place of technology within an integrated curriculum, but it was not without the risk that such practices might further entrench or perpetuate outdated understandings about the nature of the subject. The next section discusses the implications of the curriculum structure on teachers' enactment of the technological concepts.

6.6.1.2 Curriculum structure and enactment

There were contrasting curriculum structures in the two participant schools, suggestive that alternative ways of conceptualising and enacting the curriculum are being actioned (Leggat, 2015; OECD, 2012). In Lakeside Academy, the structure was described by Mike who stated that in Year 9 he would see students for "2 hours a week, for half a year" (Final Interview D, Line 57) and then they would go to another specialist area of technology for the second half of the year. When asked whether the next technological area built upon the concepts he had introduced, he explained that it was "Possible, but it depends where they head to next. Yes, they could meet stakeholders there" (Final Interview D, Line 161). It

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would appear that for Mike there was no cognisance of what students learnt in other areas of technology, and he viewed his role as being tasked with developing students' knowledge of digital technology rather than to support holistic understandings of the technology curriculum (MoE, 2007). This is an important finding because it suggests that in some schools, there may be a lack of coherence when teaching technology education within a curriculum model where students rotate to differing specialist areas.

It appeared that during the data collection phase at Lakeside Academy, there was limited understanding of the way that the curriculum was approached in the differing specialist areas of technology. The teachers were motivated by preparing students for the existing pathways in the senior secondary context, rather than ensuring that there was a collaboratively negotiated exposure to all strands of the technology curriculum (MoE, 2007). The department's professional learning focus on the *Nature of Technology* strand presented an opportunity to consolidate shared understandings about students' learning experiences in the subject. Instead professional learning focused on the transferrance of Bernadette's legitimate knowledge and contradicted the view that teachers' understanding is more effectively enabled through inquiry, which is collaborative in nature (Apple, 2013; Holland, et al., 1998; Kanjanabootra & Corbitt, 2016; Stoll, et al., 2012; Williamson, 2013).

During the observed department meeting at Lakeside Academy there was limited dialogue about the differing interpretations of the curriculum (MoE, 2007), despite evident tension between some of the teachers' beliefs underpinning its design and classroom manifestation (Reinsfield, 2016b). For Bernadette, the time constraints and her need to consolidate colleagues' understandings appeared to moderate the approaches that she used and the outcomes that she achieved. As the leader of technology Bernadette's priority was to get her staff "up to speed" and consolidate their understanding, according to her interpretation. Such an approach is contrary to the view that professional learning should enable a change in practice by supporting practitioners to be adaptive (Soslau, 2012). The consequence was that by maximising the time she had available, Bernadette appeared to discourage collegial dialogue and a constructivist approach to learning (Archambault, 1974; Cook-Sather, 2002; Duckworth, 1996; Goodwin &

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Webb, 2014; Lebow, 1993; Saxton et al., 2014). Teacher inquiry was limited to the trialling of Bernadette's resources. The identification of students' learning needs was not discussed in this professional learning context, other than from the perspective of how the curriculum levels were being taught (Fullan & Hargreaves, 1996; Timperley & Alton-Lee, 2008).

In contrast at Greenhill School, technology education was taught within an integrated curriculum model (Fraser, 2000). If technology education is taught in this manner, there appears to be a risk that it can become marginalised as being traditional in nature and a means to facilitate learning for other learning areas. It appeared that the curriculum structure in Greenhill School was limiting students' opportunity to engage with a range of technological concepts as a result of the positioning of the subject, which defaulted to the production of outcomes. The commonalities between the two schools are discussed in the next section in light of the emphasis on practical outcomes.

6.6.1.3 Commonalities and contradictions

There are emerging commonalities including the teachers' emphasis on the *Technological Practice* strand of the curriculum (MoE, 2007), whether explicitly or hidden. This emphasis in all cases was to the detriment of a focus on the other two strands of *Technological Knowledge* and the *Nature of Technology* (MoE, 2007). Consequently, there was a focus on the development of quality outcomes and a technical approach to the teaching of technology education. The enactment of the curriculum concepts were addressed by participants to differing extremes and as a result of their perceptions and practice. The contradictions present opportunities to enable technology teachers' future practice.

Four of the teachers' perceptions were espoused as being future-focused in nature but their practice manifested as technically-orientated rather than technological in three of the six observed lessons. For example, Colette described the view that technology education should encourage students to think creatively and take risks in their learning. During the classroom observation however, she taught her students in a manner that directed learning according to the pre-determined stages of manufacture for an occasional table. In this circumstance, the potential for the subject to facilitate learning that is centred upon the notions of innovation and

problem solving was moderated for by encultured community misconceptions (Hill, 2003; Sullivan, 2001).

There was some acknowledgement from teachers that there should be dialogue with students about the nature of learning in technology education, but on the two occasions that this was observed, it was minimised to how students could navigate their process-driven technological practice. There was a pervasive attitude that teachers should be making decisions about the nature of learning thereby minimising the potential for learner autonomy and self-regulation. Figure 26 highlights the key contradictions for discussion.

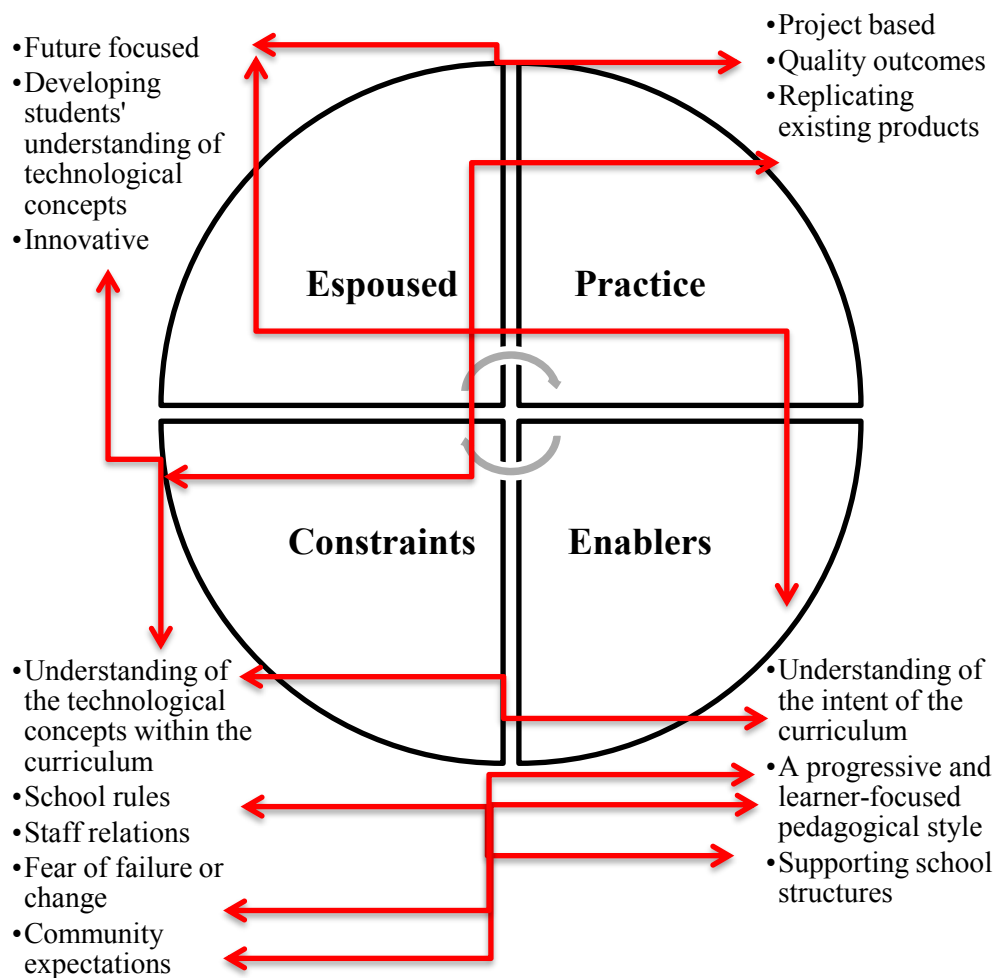


Figure 26. The characteristics in the two case study sites

Contradictions in activity theory can be used to identify opportunities and to review and make recommendations for professional learning in technology education. Figure 26 represents the key aspects for discussion, which include teachers' espoused perceptions, practice, constraints and enablers. This research

highlighted that there were five teachers who thought that they were future-focused, innovative and contemporary in their pedagogical approaches. In contrast, the findings suggested that practice was teacher-driven, project-based and focused on the replication of existing products. These findings confirmed that teachers' enacted beliefs often do not align with their espoused beliefs (Berg, Ridenour Benz, Lasley, & Raisch, 1998; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). The barriers impacting teachers' perceptions and practice were caused by their understandings of the curriculum concepts, school structures, and community expectations. Therefore, opportunities exist to foster a climate whereby teachers can be encouraged to engage with the technology curriculum for its enactment in a progressive and learning centred context and where the school structures can empower teachers' practice.

6.7 Evolving knowledge for practice

Five of the six participants had similar attitudes towards learning in technology education. For example, they advocated for students to learn skills that were pre-determined by the teacher, which led to understanding of the use of materials and a process-driven approach to product development. This pervasive view is attributed to an observed emphasis on the *Technological Practice* strand of the curriculum (MoE, 2007) and the key emerging themes that

- 1) Technology teachers make the decisions about what skills and knowledge should be learnt and when
- 2) Technology education is predominantly viewed as a means to develop skills and knowledge rather than conceptual understandings of the nature of technology and its interaction with society
- 3) Teachers' curriculum meaning making is generally driven by specialist understandings rather than knowledge of the technological concepts as they are perceived in the curriculum (MoE, 2007)
- 4) The *Nature of Technology* and *Technological Knowledge* strands (MoE, 2007) are de-emphasised because they are perceived to be less engaging and more conceptually challenging for students

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- 5) Pedagogical practices tend to be moderated by teachers' workloads, rather than the development of students' creative, critical or self-regulatory skills
- 6) Learning opportunities are usually centred upon the replication of existing products, as determined by the teacher.

The following diagram presents some enablers to counter these attitudes and practices.

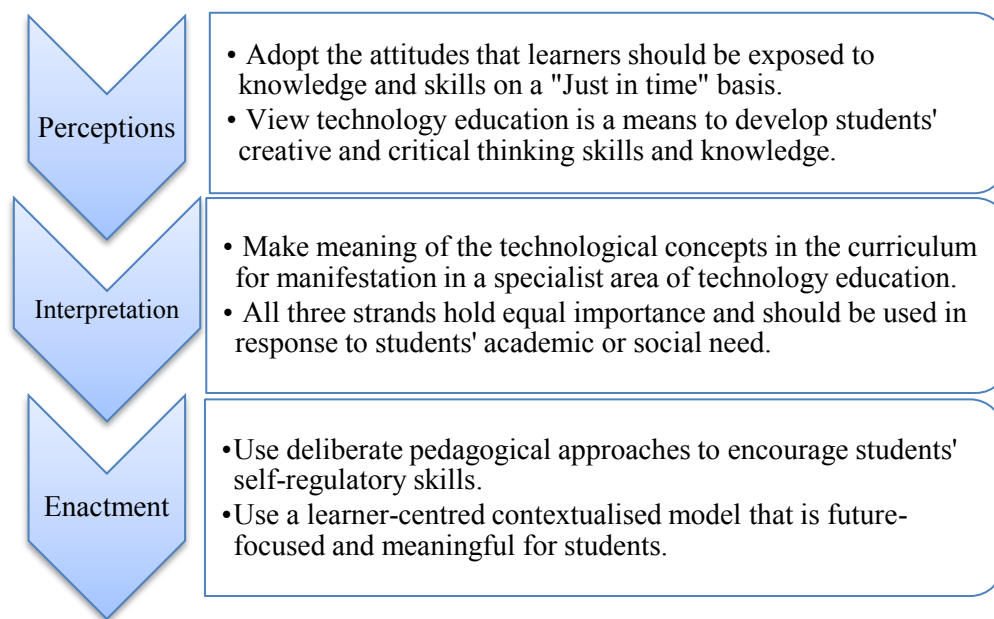


Figure 27. Enablers to address the implications of the research findings

The following explanations are intended to challenge the research findings to enable teachers' transition to a new conceptual space (Meyer & Land, 2006). In this research, participants' perceptions were mediated by a variety of factors at different stages of their pedagogical processes. The technology educators all emphasised the need for students to produce quality outcomes, which was suggestive of a ritualised form of knowledge within their community (Meyer & Land, 2003; Perkins, 1999). Practical skills and knowledge of materials are important to students' understanding in technology but an overemphasis on the *Technological Practice* strand is likely to diminish the conceptual role that the subject should also embrace.

An underlying assumption evident in the research, substantiated by the nature of the professional learning, was that the technological concepts in the curriculum

could be interpreted as the result of teachers' specialised knowledge in their learning context. This supposition is significant and challenged as a result of this research.

6.7.1 Teachers' perceptions

There are two key concepts for discussion here, which relate to the ways that technology teachers' perceptions can enable, moderate or limit professionals' practice. The first asserts that learning in technology education can benefit from learner-centred pedagogies. Where teachers default to traditional approaches for the teaching of technological concepts, pedagogy is not easily connected with the values represented in the curriculum (MoE, 2007). For example, if a teacher views learning in a technology classroom as being their sole responsibility, dialogue and engagement with concepts or even outcomes are more likely to be reflective of their own values (Williams, 2013). Further, such approaches position the subject as being primarily about the transmission of teachers' knowledge, rather than as a means to explore and respond to students' interests.

The challenge for teachers is that a learner-centred approach is likely to require them to be responsive to, and facilitative of, the development of knowledge and skills as they emerge in the classroom. Such an approach is dependent upon practitioners having the confidence, motivation, knowledge, and interest to accommodate a range of differing learning opportunities, from a variety of disciplines and in response to students' interests.

The research finding of teachers' persistent preoccupation with the development of quality outcomes indicates a type of thinking can be associated with teachers' beliefs about technology education. To de-emphasise the need for students to produce quality outcomes would require many technology teachers to revisit their perceptions and potentially challenge their community's view of technology education. Practical work is a pertinent means to engage students in their learning in technology education. The nature of the practical work should however, also be developed through experimentation, prototyping, and testing, not just through the replication or adaptation of existing products.

The practical skills and knowledge in technology education classes were taught according to the teachers' plan for the learning. Instead, they could be taught "Just

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in Time” and as the result of student interest (potentially in future-focused topics) (Novak, 2011; Osmond & Goodnough, 2011). Such an approach would provide learners with increased autonomy, and foster a climate that enables them to learn about technology education in an iterative manner, and according to their interests. This is in contrast to an approach where teachers pre-determine the nature of learning through the replication of existing products. The challenge however is that to effectively manage the learning in an authentic context (for example), teachers need to be able to respond to the direction that students choose to follow in their learning. Just in time teaching (JiTt) is a means to manage such a process.

JiTt (also known as a Flipped classroom) is a pedagogical strategy that has been represented in e-learning platforms (Novak, 2011; Osmond & Goodnough, 2011) and can enable teachers’ understanding of their students’ learning needs to improve academic outcomes and increase engagement within a discipline (Hughes, Luo, Kwok, & Loyd, 2008). Whilst this notion is represented in the literature as being a means to foster students’ learning outside of the classroom, prior to formal lessons, JiTt is proposed here as an enabling concept for technology teachers to support the fostering of an active learning environment in the classroom (National Research Council, 2000). It could provide an alternative where students can direct their own learning, as a result of their interests in technology education. This pedagogical approach would be significant because it could mean that teachers are positioned to support students’ learning, rather than direct it. For example, rather than the teacher deciding what skills and knowledge learners should be exposed to in Year 9 then teaching them out of context, the students could instead

- 1) Explore their own learning context from a problem solving perspective, and to address a need or opportunity
- 2) Identify what they need to know and develop understanding at a time that makes sense to the learner
- 3) Construct knowledge collaboratively or individually to facilitate a successful concept or outcome.

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For some technology teachers however, this may present some challenges because it is likely to present an approach that is contrary to their perceptions of the purpose of the subject. In a context where there are Co-teachers working collaboratively to support students' learning, this approach is likely to be easier to realise.

Regardless, a students' engagement with technological concepts (from the curriculum) should drive the knowledge and skills that are acquired to empower their learning in a personally meaningful way. In this context, it is primarily the teacher's responsibility to provide guidance, have understanding of the curriculum concepts, and determine how this translates to the specialist content knowledge (in their area of technology). The ways that teachers navigate this process however, will determine whether they react to, anticipate, or respond with the support or skills that students need-to-know as the learning occurs.

6.7.1.1 Attitudes towards teaching

The ways in which teachers use pedagogies that are responsive to students' interests can be attributed to their views of the purpose of education - specifically whether they see it as a means to develop citizenship, students' holistic development, occupational preparedness, or to respond to social and economic need (Adler, 1982; Tyack, 1988). The research findings indicate that whilst technology teachers are likely to align with differing ideologies, it is also their own experiences as well as the socio-cultural context that will moderate their practice (Reinsfield & Williams, 2015; Schiro, 2008).

The research findings confirm the view that teacher perceptions and the dominant discourse within a teaching community influence the way that professionals interpret, make meaning, and develop their professional identity or practice (Biggs, 2006; Brookhart & Freeman, 1992; Cohen, 1988; Dakers, 2006; de Vries, 2005; Fox-Turnbull & Sullivan, 2013; Hoyle, 2008; Kadi-Hanifa & Keenan, 2016; MacGregor, 2017; Zlatković et al., 2012). In other words, the socio-historical context of a school and community inevitably influences the ways that teachers' thinking and practice are mediated.

Interestingly, when describing their views of the nature of technology education in their classroom, all participants perceived that their teaching of the subject

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should be approached through a process-driven approach. This approach appeared to be the default model for learning in technology education. Graham described the potential for learning in technology to be an iterative series of events, and was open to dialogue with students about the nature of their learning. As a result of such dialogue for example, Graham gained insight into whether students were enjoying what they were learning. It is pertinent to note here, that in Greenhill School, planned learning opportunities had been pre-determined by the teachers *before* the students were in attendance. In this context Co-teachers had been given time to develop a plan together and integrate two learning areas of the curriculum. Whilst some of the activities did encouraged negotiation between students and their teachers, the students had not been included in decisions about the focus of the project and this appeared to be detrimental to learners' engagement.

To change technology teachers' attitudes and approaches to pedagogy, there needs to first be an appreciation that students are more likely to engage in their learning if opportunities are focused on their interests or if they are involved in the decision-making processes about their learning. A strategy to accommodate such an approach would be to provide students with a sufficiently generic learning context, to allow them to navigate their own learning, but also to introduce them to the technological concepts within the curriculum at an appropriate level. It is acknowledged here however, that there are several factors that can marginalise such an approach. Figure 28 identifies how teachers' perceptions can influence their practice in technology education and the proposed transitions in thinking required to accommodate a contemporary approach to education.

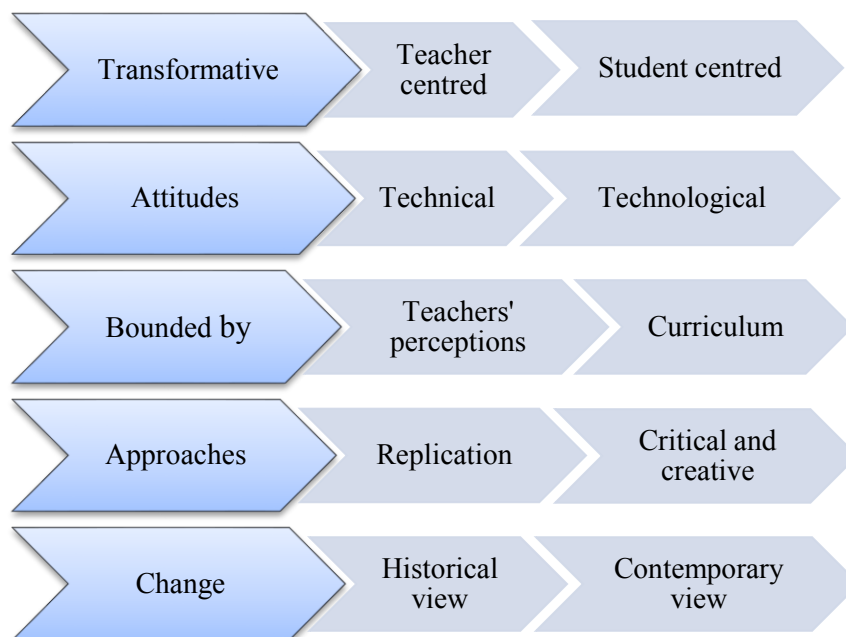


Figure 28. Changing perceptions

Figure 28 identifies how technology teachers’ perceptions can manifest as traditional or contemporary practices. There is a place for students to replicate products (if this is appropriate to the learning context) but learner-centred approaches provide an alternative to fully engage and extend students’ understanding of future-focused issues in technology education.

Learner-centred approaches in technology can occur in differing ways - from negotiating the context of the learning with students to pedagogical approaches in the classroom that advocate for the development of student autonomy and skills in self-regulation. To facilitate this approach however teachers may need to review their understanding and stance about the purpose of the subject. They might need to re-position their perceptions of technology education as a means to foster innovative thinking, rather than to solely develop practical skills.

The way that technology education is manifest should not be solely bounded by the teachers’ attitudes, values, judgments, or experiences, but instead it needs to be inclusive of the technological concepts (as presented in the curriculum) and the nature of innovation in society. The curriculum should be the starting point for teachers to develop a generic learning context that they then present to students - if this is the strategy they choose to use. The learning context could be inspired by global or local need to generate ideas and different ways to conceptualise

technological issues. To accommodate this approach learning needs to emphasise creative and critical thinking and provide opportunities for teachers to focus on future-focused contexts. This is discussed in the next section.

6.7.1.2 *Ways of thinking*

The current curriculum was viewed by some “from the outset... as something distinct from technical education, [e.g. workshop, craft and home economics]” (Ferguson, 2010, p. 6). The findings in this research suggest however, that some teachers have found it difficult to change the way that they conceive technology education as a subject. As has been discussed already, a teacher’s approach to technology education is not only affected by their perception and practice (as influenced by their school context) but also by the way that they *think* about their practice. For example, Colette and Bernadette both suggested that there were implications for technology teachers, whose understanding of the subject was limited by their previous Trades experience. This perception aligned with Heidegger’s (1949, 1977, 1996) view that individuals’ attitude towards technology could be attributed to a particular notion of *being*. *Technological* versus *technical* thinking is a means to elaborate on this point.

Bernadette modelled technological thinking when she described her approach to the “Sunglasses project” (See Section 5.3.2.1). Whilst her idea for the project was motivated by a practical outcome, her interest was piqued not by the replication of the product but rather by the knowledge underpinning its development. In particular, she was interested in the reasons *why* sunglasses had evolved to address a societal need. Specifically, Bernadette designed the “Sunglasses project” for a group of Year 7 and 8 students (Ages 11-13). She articulated a *technological* thinking process that addressed all three strands of the technology curriculum (MoE, 2007, p. 32) and described the types of pedagogical strategies that she would use. These are illustrated according to the curriculum stands, the learning focus and pedagogical approaches below.

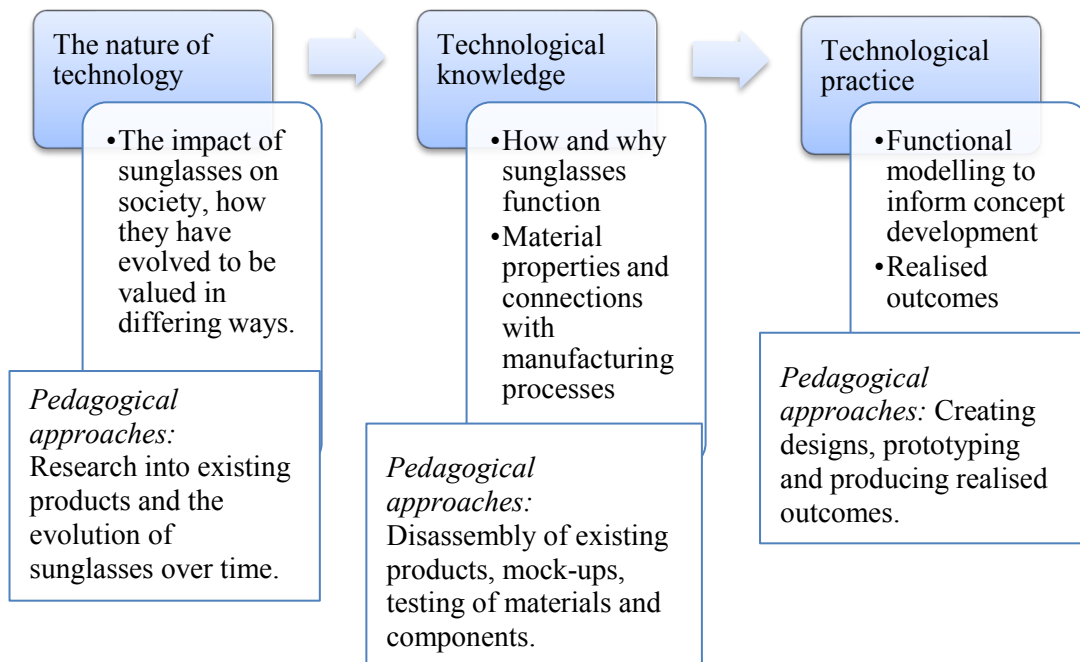


Figure 29. Technological thinking in practice

Bernadette and Colette asserted the view that teachers who came from a Trades background preferred order and organisation in the classroom, suggesting that these teachers' approaches were more likely to prioritise the quality of outcomes. This finding was significant because it provided insight about why the subject has not evolved because of the continued association with its technical roots. If technology education is approached in this manner there are likely to be missed opportunities to explore the interconnected nature of technology, society, and the environment. Equally, if a teacher's thinking starts with the making of an artefact, and pre-determines the stages of production, students are less likely to be involved in decision making processes that can inform their future technological practice or meaningful engagement with the subject.

A technical way of thinking is more likely to represent a traditional perception of the subject, where the skills and knowledge to enable the production of outcomes are emphasised, to the detriment of the *Nature of Technology* and *Technological Knowledge* strands of the curriculum (MoE, 2007). To transform their perceptions about the nature of technology education, teachers might be required to transition from a technical way of thinking to position the technological concepts at the forefront of students' learning. A future-focused and learner-centred approach to

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technology education provides the opportunity to negotiate how learning is occurring in the classroom. Teachers are then required to guide the learning context to ensure that there are opportunities for the curriculum concepts to be naturally addressed.

Alice, Bernadette, and Colette described a teaching community where at times, the learning (which focused upon the replication of products) conflicted with their understanding of the technology curriculum. Associations were made (by parents and colleagues) between the quality of outcome development and effective teaching. As has been discussed throughout this thesis, the development of quality outcomes is more than just making things; it is about technological practice that is informed by creative and critical thinking [and] responsive to the “cultural, ethical, environmental, political, and economic conditions of the day (MoE, 2007, p. 32).

The perception that the replication of quality outcomes defines the nature of the learning in secondary technology education classrooms indicates that the subject is still aligned closely with its technical beginnings. In a range of differing ways, the participants’ communicated historical understandings of the nature of technology education rather than the more contemporary view that a teacher’s role is to respond to their students’ social and academic needs (Jones, et al., 2013; Jones & Compton, 2009; Reinsfield, 2012; Williams, 2009). Pedagogical practice in technology education can exploit the potential that the subject offers, to facilitate dialogue about future-focused issues and engage in experiential tasks to encourage critical and creative thinking. To follow are the key features that represent two conceptions of technology education.

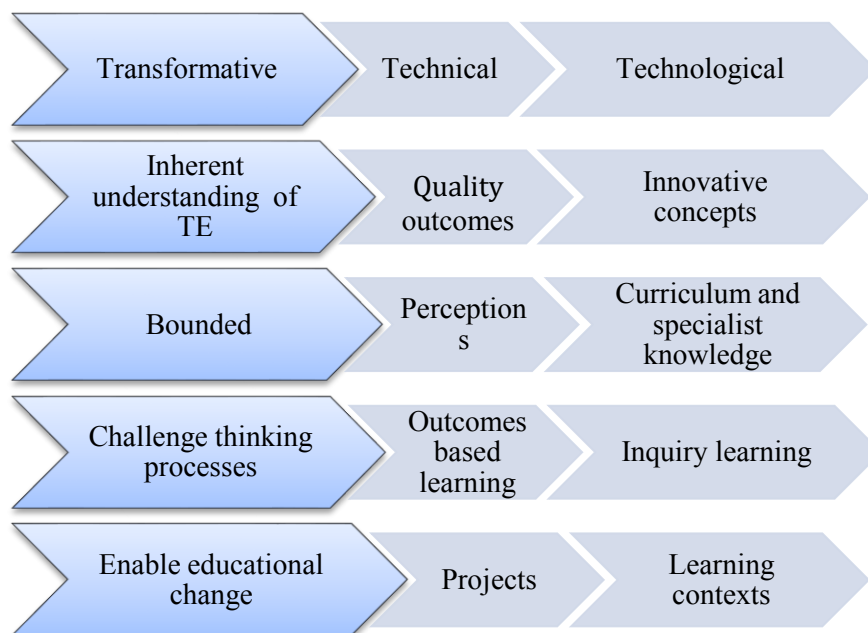


Figure 30. Conceptions of technology education

Figure 30 outlines the features to define the differing ways of thinking about technology education, which leads to the assertion that technology teachers need to de-emphasise the importance of quality outcomes in order to facilitate an experiential, contextualised and inquiry-based approach to learner-centred pedagogies. It is acknowledged that to transform teachers' ways of thinking there might need to be a change in their perceptions to include both a technical way of thinking and a technological conception of the nature of the subject. For example, teachers could consider an inquiry-based or iterative approach to learning, rather than defaulting to a project-based approach. This provides the potential to enable a de-emphasis on the product to be developed and a focus on the understanding of technological concepts. To navigate a change in practice however, teachers would need to be open to fostering new knowledge as it is required, to be responsive to student need and to focus on creative and critical approaches to thinking. A teacher would also need to appreciate that whilst the practical nature of the subject is one of its strengths, it is not its only feature; the *Technological Practice* strand is only one of three strands to be addressed within the curriculum (MoE, 2007).

All participants discussed the conceptual and practical nature of technology education and the influence of these features upon their manifesting practice. For example, Colette had been directed by both of her department leaders to focus

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more explicitly on the quality of her students' outcomes because this was what parents expected - the work that students were producing was described by Bernadette (S1) and Alice (S2) to be at an unsatisfactory level. As leaders in their areas and as practitioners in their own classroom, both Alice and Bernadette acknowledged this tension but also advocated for experiential learning where the development of quality outcomes was not necessarily the focus. In such a context, the intention of the learning was to facilitate deeper understanding of the properties of materials.

Mike (S1) felt less constrained by the need to produce quality outcomes because in his view digital technology was conceived differently to other technological areas. He asserted that there was less community understanding about what learning in digital technology education might *look like*. As a consequence he emphasised prototyping, planning, making, and students' evaluative processes in his classroom. There appeared to be fewer historically placed constraints upon Mike, meaning that digital technology teachers might be better positioned to enact the curriculum if they are motivated to do so. For specialist areas like resistant materials and food technology, there appear to be persisting misconceptions, which are associated with the community members' experiences of the subject (Barlex, 2016).

The challenge in this context is that teachers' professional practice can be questioned if a child's learning experiences are not what they (or their parents) anticipate. For example, if parents receive a product at home which is poorly manufactured but has involved considerable testing, problem-solving, and conceptualisation of creative ideas, it might not be as highly valued. Equally, if a teacher emphasises the making of high quality outcomes in their classroom and works in a school where the community expects the same, they are potentially less likely to see a need to change their practice or explore new ways to enact the subject. Colette suggested that such ways of thinking had led to an attitude in technology that quality outcomes equated to effective teaching, where technology education was reduced to a systematic and process-driven approach.

Even if teachers can appreciate that their practice does not represent the intent of the technology curriculum, change may not occur. For example, Helen was cognisant that she needed to track where her junior programme addressed the

curriculum and could see the benefits of doing so but had not yet found the time to prioritise such practice. A teacher needs to be motivated to challenge the discourse in their school environment and in order for teachers to enable change, they will need to be able to explain the benefits of new approaches, as well as the thinking processes that underpin such learning, to their school community.

All participants acknowledged that to succeed in technology, students needed to have an understanding of the specialist area within which the learning was situated. This was attributed to a teachers' professional responsibility to have sound content knowledge in their area of technology education. Interestingly, some teachers valued their specialist knowledge over their knowledge of the technological concepts, which in turn affected how they engaged with the curriculum. This will be discussed in the next section.

6.7.2 Interpretation of the curriculum

One of the aims of this research was to explore how technology teachers engaged with the New Zealand curriculum (MoE, 2007). Some of the barriers identified that limited teachers' practice included their cultural capital (Gay, 2010), consolidated practices, or emerged as the result of the organisational structures in the school (Alice, Colette, Helen, & Graham). There was a general consensus amongst the participants that because the purpose of technology education was not well understood by school communities, there was no accountability for teachers who decided to adopt a technical approach to the subject.

Regardless of the factors affecting secondary teachers' practice however, it is clear that there is a need for a professional learning model, which supports evolving practices in technology education (Jones, 2009; Williams, 2012; Williams, & Lockley, 2012). Such a model could be transferrable to other curriculum areas (or countries) where it is based upon the assumption that there are differing representations of the ways that professionals' are likely to engage with a curriculum. In New Zealand, there appears a need for a sustained approach, which supports technology teachers to reflect upon their curriculum-based practice to transform their thinking so that it more explicitly focuses on students' learning needs. Such a professional learning approach is still likely to cause some resistance to change however.

Even when teachers have sound understanding of the curriculum, there can be personal factors that limit or moderate their engagement and interpretation of it. For example, Mike acknowledged that when teaching a class, he only referred to the curriculum (MoE, 2007) at the start or end of a project to assess what concepts might or had been covered. Mike identified paperwork as his area of weakness but felt confident that his knowledge of the curriculum was sufficient to provide students with an appropriate experience and direction in digital technology. Such an approach suggested a reliance on his existing knowledge and a “laissez faire” attitude towards curriculum leadership. To be confident that the curriculum is being addressed, teachers need to acknowledge the importance of planning for teaching in a deliberate, sustained, and purposeful manner, whilst also being flexible about responding to their students’ academic and learning needs.

6.7.2.1 Generic and specialist interpretations

The ways that participant teachers navigated the curriculum when making meaning of its concepts for their specialist areas of technology is a new finding for discussion. In the secondary school setting, technology teachers need to be able to interpret the curriculum both in relation to its technological concepts but also to contextualise the learning within their own specialist area. To do so teachers need to appreciate that the technological concepts define the curriculum and that a specialist area is a means to situate the learning; it provides a way to expose students to knowledge from a range of different disciplines.

Whilst specialist knowledge is necessary to a technology teacher’s professional practice, more important is the need to understand the technological concepts from the curriculum (MoE, 2007), which should conceptualise the nature of the learning. To acknowledge this distinction, teachers need to appreciate that teaching their specialist knowledge does not necessarily equate to students’ understanding of or alignment with the technological concepts. Conversely, the technological concepts can be interpreted and enacted differently for each specialist area and still accommodate curriculum intent. The differing perspectives towards learning in technology education are outlined below.

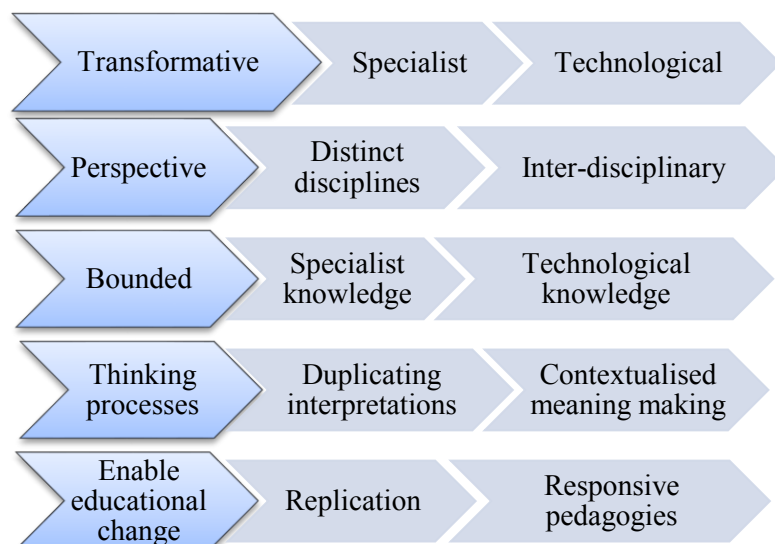


Figure 31. Transitioning technological concepts and specialist knowledge

The findings indicate that the way that teachers make meaning of the curriculum appears to be defined by their specialist area, rather than through a primary association with technology education itself. This is a pertinent finding that has significant implications for the way that teachers interpret and engage with the curriculum.

Bernadette’s understanding and experience of interpreting the curriculum was well established when making meaning of it in her specialist area of hard materials. However, her ability to translate what this meant for other specialist areas was limited by her understanding of those learning contexts. This has implications not only for a technology teacher’s practice but also for the subject’s curriculum leadership. For teachers to make meaning of the curriculum, it is necessary to foster a professional learning context that supports them to form their own connections between the technological concepts and specialist area knowledge. Teachers may still choose not to engage in a purposeful way however, as exemplified by Helen.

6.7.2.2 *Making meaning of the technological concepts*

There is a complex relationship between technology teachers’ understanding of the curriculum concepts, which appears to derive from their own experiences and specialist knowledge. This finding presents an opportunity for future professional learning in New Zealand because the idea that teachers’ interpretation of the

CHAPTER SIX: Discussion and Implications

curriculum can be limited by their specialist understandings is new. For example, whether a teacher has minimal or extensive specialist knowledge could equally limit teachers' interpretation and enactment of the curriculum concepts.

Colette experienced difficulty when making meaning of the curriculum partially because of her lack of exposure to it but also because of her inability to interpret how the generic concepts could be applied within her own specialist area. She was unable to interpret the examples provided within an alternative learning context and translate them for her own evolving practice. This is pertinent because there is an assumption that specialist teachers will have the knowledge and expertise to engage with the technological concepts presented within the curriculum, as the result of their previous work experience or study. There is tension associated with such a view.

A disparity was identified between some teachers' perceptions about the nature of technology education and their own specialist area. For example, Helen's content knowledge in the area of food technology was predominately based upon her experience of teaching home economics in South Africa. Her understanding of food as a material centred on existing products and solutions, rather than the potential for students to develop innovative outcomes in response to an *authentic* need or opportunity. For Helen, school-based professional learning appeared problematic because (in Lakeside Academy) Bernadette assumed that teachers had some relevant specialist knowledge required to make meaning of the technological concepts being discussed. The examples provided for Helen during professional development were too far removed from her existing understandings to make sense for application in her own practice.

The findings for this research challenge the notion that because teachers have specialist knowledge they can automatically connect that knowledge to the technological concepts in the curriculum (MoE, 2007). It appears that teachers' experiences can instead limit their engagement with curriculum concepts because understanding depends upon the nature of the knowledge and the thinking motivating its application. The connections between specialist and curriculum knowledge can be partially mediated through exemplars, but it is the way that teachers' perceive technology and technology education that can be the enabler to innovative practice. This notion is discussed in the next section.

6.7.2.3 Student need and curriculum intent

Curriculum can be interpreted as a result of the school setting or students’ academic or social need. Learning contexts for students should incorporate all three strands of technology education within their junior secondary school experience. My research findings confirm that some teachers of technology can be progressive, regressive, or indifferent to the enactment of the curriculum (Jones, et al., 2003; Mansell, et al., 2001; Paechter, 1995). The key features that influenced how teachers were interpreting the curriculum for their practice in technology education are outlined in Figure 32.

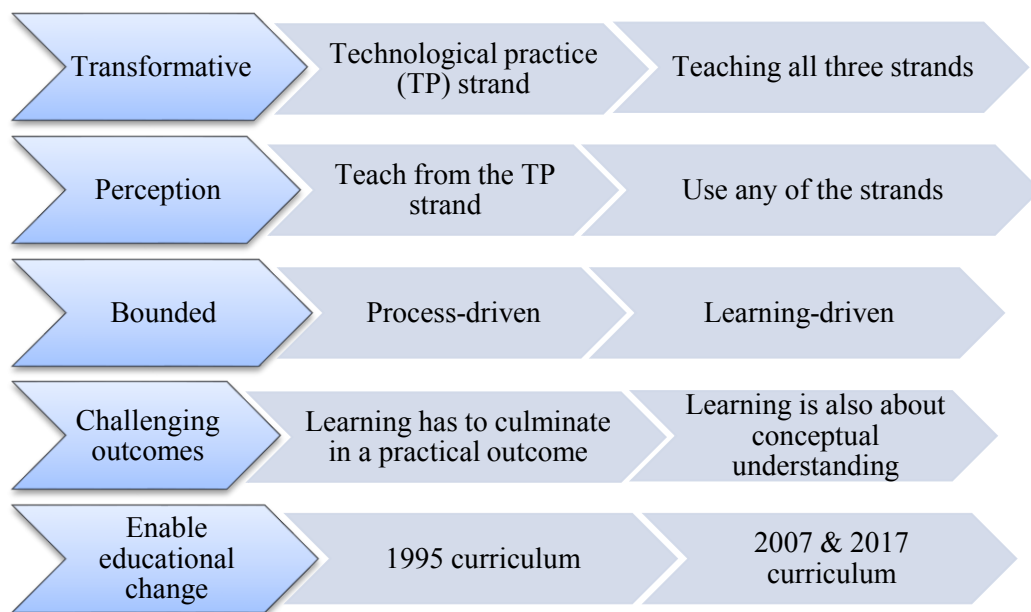


Figure 32. Teachers’ interpretation of the curriculum

Figure 32 focuses on the ways that participant teachers interpreted the curriculum, to support their students’ learning in technology education. To maximise learning opportunities in technology, teachers need to foster learning that incorporates all three strands of the curriculum rather than solely emphasise the *Technological Practice* strand (MoE, 2007).

Further, rather than defaulting to technology teaching that uses a process driven approach (such as the design process for projects), teachers could use an inquiry based model, to align with the curriculum and at the same time respond to students’ interests in a naturally occurring manner. To do so teachers need to appreciate that not all learning in technology requires a practical outcome and that

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students can learn just as appropriately if content is derived from the *Technological Knowledge* and *Nature of Technology* strands.

For teachers to engage with the curriculum they also need to be motivated to familiarise themselves with it. For example, Helen relied upon the connections that Bernadette was making on her behalf, which she passively accepted. Helen also depended upon the use of templates that replicated the *Technological Practice* curriculum concepts in each of her junior units of work. The observed lesson showed that she was trialling content from the *Nature of Technology* strand, but she taught this without any purposeful understanding. Throughout the 18 months of data collection and as a recently appointed leader of her specialist area of food technology, Helen did not appear to have consolidated any new understandings of the curriculum, despite her exposure to school based and external professional learning opportunities. She conceded that this would be of value if she chose to offer food technology as a future pathway in the senior secondary school. Helen's interpretation is likely to be representative of some teachers in technology education, whose practice has not evolved to adapt to the contemporary needs of the curriculum (MoE, 2007, 2016). This supports the view represented by Williams, et al., (2015) who stated, "In an ever-changing environment, some things stay the same" (p. 271).

6.7.3 Enactment of the curriculum

Each teacher's starting point for curriculum enactment was different and did not appear to be determined by student need - other than the perception that students needed to develop certain skills and knowledge to enable their technological practice. Bernadette and Mike started with the concept or idea for a project and then tracked the potential learning against the curriculum to see how it aligned. Bernadette was motivated by what she perceived would interest her students. Mike focused on scaffolding students through the learning that introduced them to the concepts within the *Technological Practice* strand and towards the senior secondary pathway in digital technology, whilst also developing their self-management skills.

For Alice and Graham, they began with a clear plan regarding which parts of the curriculum were being addressed, but when the projects did not engage the students in their learning, they defaulted to making tasks that were reflective of

the technical roots of the subject and addressed some aspects of the *Technological Practice* strand. This affirms that whilst a teacher might be able to conceptualise the curriculum appropriately, it does not automatically translate into practice. Further, teachers might recognise that their pedagogies should be learner-centred, but experience significant barriers to their enactment of this approach.

6.7.3.1 *Student-centred and future-focused pedagogies*

In all cases, teachers were pre-determining - on some level - what learning could occur. This is not unexpected, as it is a teacher's professional responsibility to ensure that learning is progressing, in accordance with the school's expectations or to adhere to the curriculum requirements (MoE, 2007). However, there was an emerging tension between teachers' perceptions and their manifesting practice. Where student autonomy and means of self-regulation were espoused as being of importance to some practitioners, agency was constrained to a choice in practical outcome or to the direction that a student took within a pre-determined project. This notion presents an opportunity for further research within the current educational climate. The government mandate in New Zealand is that all schools will have learner centred pathways, champion 21st century pedagogies and provide quality, responsive, and future-focused teaching (MoE, 2016b). To facilitate this process, teachers must understand how to support student agency to enable learner-centred pedagogies in technology education. The findings suggest that teachers are likely to be struggling with this pedagogical necessity in the secondary school context.

Learner-centred pedagogies were described as students' completing research tasks, or working together collaboratively in groups. The technology teachers in this research perceived a need to limit learner-centred approaches so that they could manage their classroom and resources effectively. For example, if each student were developing a response to their own technological need or opportunity, there are both resource and knowledge implications for the teacher. It is much easier for a teacher to manage this process by deciding what knowledge and skills students' need, to pre-determine what resources will be required for students to develop the same outcome, and to plan for learning that can support the development of a replicated but successful outcome. There are workload implications for a teacher who strives to be responsive to students' learning needs

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in technology education. An increased workload is likely to be prohibitive for some teachers unless they hold strong beliefs about the benefits of such an approach.

Bernadette and Mike both acknowledged that students' could be provided with choice, but they indicated that there were times where learners had not yet developed the skills or capacity to work in an independent fashion. As a result, students needed to be provided with more structure in their learning. Alice and Graham asserted too that students should make decisions about the nature of their learning and negotiate the direction that they followed based on their interests. In practice, this philosophy proved problematic. Alice's students did not have the skills or motivation to work collaboratively towards a successful outcome in technology. For Graham, student choice and working within an integrated curriculum meant that he was unable to maintain the integrity of the technology curriculum and was required instead to revert to the replication of existing products. The context of the learning was also deemed to be of importance.

In technology, students can work within a generic authentic context and identify a need or opportunity to address a brief. All participants identified the importance of student engagement and interest in the topics being taught in technology education. For Helen, this had limited her to junior programmes to focus on a series of practical activities (because the students enjoyed eating), with the occasional activity to indicate adherence to the curriculum. Helen's pedagogies were teacher-directed and student choice was limited to the different ingredients that they could use in the production of their outcomes.

All participants indicated that they were motivated to keep their practice current and address their students' social and academic learning needs but this was not always realised. Alice and Graham were both situated within a new school, teaching an integrated curriculum, with co-teachers who held differing perceptions about the nature of technology education. The projects they developed during the data collection phase were newly conceived and had been developed before they knew their students' interests, or academic or social needs.

Mike appeared motivated to enact the technology curriculum but suggested that his teaching was limited by students' ability to take ownership for their learning. He argued that students' learning needed to be carefully "scaffolded" in

technology, towards a level of independence that enabled them to apply previously learnt concepts. This view was also supported by the teachers at Greenhill School who argued that many of the issues caused by students' lack of engagement resulted from a de-emphasis on routines and expectations during the establishment phase of the new school. It would appear that there is a need to manage student autonomy towards self-regulation, to support meaningful engagement with learning.

6.7.3.2 Empowering learners

The nature of a progressive, learner-centred approach relies on the notion that students will be self-regulated and interested in technology education. To support learning, teachers are required to use pedagogical approaches that sequence the development of understandings and encourage students to take ownership of their own learning. This approach is in direct contrast to a classroom where the teacher is making all decisions about the learning and students are provided with information about the stages to complete when replicating an outcome.

This final emerging theme highlights that whilst most participants were aware of the potential for technology education to foster learning that was critical, creative and innovative in nature, they were unable to translate this into their professional practice. Teachers' practice was predominately affected by their classroom management skills and understanding or preparedness to respond to students' learning needs. Some teachers represented the view that students should engage as the result of the chosen context of their learning (as determined by the teacher) and connections were made between engagement and a perceived lack of self-regulatory skills.

For Alice, there was a manifesting (and acknowledged) tension in her classroom because she decided what students would be learning and the nature of the students' collaborative work. Her students were disengaged during the car project and despite various interventions where she tried to re-engage them in their learning - she felt there was a need to discard the project and returned to skills-based projects. For Alice, the constraint was her need to respond to students who were unable or unprepared to comply with the classroom rules, to enable their successful learning. Alice acknowledged that it was her responsibility to direct the

learning, which she felt was unsuccessful because she did not have sufficient understanding of the learning context to support students' continued engagement. There is an evident tension between the perceived need to provide engaging (student-centred) learning contexts and to develop the pedagogical understanding and content knowledge to support such an approach. The next section presents a model for professional development with a view to respond to the emergent tensions in technology education.

6.8 A proposed professional learning model

Professional learning models that use a combination of externally and school-based approaches are only likely to be partially successful in developing a teachers' professional knowledge and practice. If teachers' motivation to change does not extend beyond meeting either the school's focus, or the required professional standards there will be implications for the effectiveness of any professional learning model. An individual's motivation to change has to extend beyond professional expectation and the learning must be personally meaningful, to enable a sustained change in practice. There need to be structures in place to ensure that teachers are adaptive professionals who inquire into their practice and engage with a range of contemporary pedagogical approaches.

The following professional development model proposes a structure that provides choice for the teacher to balance external and school-based professional learning and to ensure that their identified gaps between theory and practice can be addressed. It illustrates how organisational challenges can be navigated differently within each learning context (Hoban, 2002). The intention is to build sustained teacher capability in technology education, but the model is sufficiently robust that it could be trialled with other curriculum areas.

Within this model, it is proposed that there should be a partnership between academics, teachers and (as relevant) members of industry to establish a climate, which fosters transformative practice and is future-focused in the sense that it addresses technological need, as identified within authentic contexts. This is distinct from other professional development models being offered to technology teachers, which generally expose practitioners to others' best practice. Current models for professional development in technology education are beneficial for those who are practicing at a level where they can make the connections between

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the best practice and their own - they have the potential to further marginalise those teachers who are experiencing difficulty in establishing their place in the profession.

Fostering partnerships is imperative to being responsive to new and emerging challenges in education (Cowie & McNae, 2017). Teachers need to be the agentic party in this process so that they can enable change in schools, particularly when making meaning of the curriculum, for implementation (Stenhouse, 1981). It is the accommodation of student voice that can support the re-conceptualisation of a school curriculum, and a learner centred approach to technology would be a means to realise this (McNae, 2017).

To foster innovative practice and counter resistance to change, the proposed professional learning model needs to support and acknowledge the place of a teacher's current educational practice (Köksal, 2013; Persellin & Daniels, 2015). The professional learning with which teachers engage should also reflect the recently revised mandated professional standards that are advocated by the New Zealand Education Council (NZEC) (2017). Internationally, professional development and learning structures differ in response to their cultural content, and in the New Zealand context, *Whakamana*, *Manaakitanga*, *Pono* and *Whanaungatanga* are valued characteristics used to define an effective classroom environment (NZEC, 2017). A teacher needs to provide a classroom environment which models

- *Whakamana*: All learners should be empowered to reach their potential through high quality teaching
- *Manaakitanga*: The classroom is a welcoming, caring and creative learning climate, where everyone is treated with respect and dignity.
- *Pono*: A teacher uses their professional integrity by being fair, honest and just
- *Whanaungatanga*: The teacher fosters positive and collaborative relationships, which are developed with colleagues, learners, families/whanau and the wider community (p. 6).

Table 16 provides a structure for the professional learning, developed as a result of my research findings. The key findings include teachers'

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1. Conceptions of the subject, and their influence on what they value and emphasise in their classroom
2. Reliance on habitual knowledge through their persisting emphasis on the practical nature of the subject and teacher-driven practice
3. Emphasis in specialist knowledge and the way that it affected their engagement with and enactment of all 3 strands
4. Requirement to adapt their practice according to the way that learning was organised in their school (e.g., as a result of the timetable or curriculum structure)
5. Need to address community (mis)understandings of the role of the subject

The proposed model provides teachers with a choice as to whether they prefer to combine external and school-based professional learning. The model is designed to accommodate teachers need to navigate organisational challenges whilst also enabling a responsive approach to pedagogy. The intention is to build sustained teacher capability in technology education. The key curriculum concepts are presented to indicate what practitioners are required to address in their teaching of technology. Professional learning strategies are suggested, to support the development of curriculum understandings and facilitate the development of evidence that reflects how their practice aligns with the professional standards for teachers in New Zealand (NZEC, 2017).

Table 16. An overview of the proposed professional learning model

<i>Phase one</i>	<i>How do teachers</i>
Teacher characteristics and inquiry questions (KF's 1, 3 & 5)	Value knowledge? Interpret the curriculum? Perceive the relationship between technology and society? Use pedagogical strategies to model the use of digital tools? Adapt their practice, to accommodate students' needs?
<i>Phase two</i>	Teachers can provide evidence of
Link to teachers' professional standards (NZEC, 2017, pp. 18-22) (KF's 3, 4 & 5)	Engagement with <i>professional learning</i> through inquiry, collaboration, problem solving, to improve student outcomes Establishing and maintaining <i>professional relationships</i> , to improve students' learning outcomes Fostering a <i>learning focused environment</i> <i>Designing learning</i> that makes explicit connections to the curriculum by

	using pedagogical practices that responds to students' technological needs <i>Teach</i> in an informed and adaptive manner.
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<i>Phase three:</i>	<i>Teachers can engage in</i>
Professional learning strategies to revisit the teaching of key curriculum concepts in technology (MoE, 2007, 2017)	Self-assessment and goal setting Meaning making of the curriculum, from a future-focused perspective Anchored instruction Individual or collaborative inquiry Critical reflection and problem solving.
(KF's 2, 3, 4 & 5)	<i>Students need to learn</i> The conceptual and practical nature of technology education How to develop technological outcomes in a creative and critical way How to respond to societal need and make informed and ethical judgments In an iterative manner

6.8.1 Threshold concepts and need for professional learning

A threshold concept is described as being “akin to a portal, opening up a new and previously inaccessible way of thinking about something” (Meyer & Land, 2003, p. 1). This idea provides an opportunity for transforming teachers’ thinking and practice, in technology education. It is acknowledged that learning can depend upon the discernment of an individual’s understanding - in this case, of technological concepts, which can lead to a new comprehension or application in practice (Marton, 2007). The technological concepts that define the technology curriculum (MoE, 2007) have been identified here as troublesome for some teachers, who can find it challenging to make meaning of them, for their own specialist area.

In Figure 33 the identified troublesome knowledge derives the question, “How can teachers’ make meaning of a curriculum to develop their knowledge for practice?” This is represented as a continuum. Proactive knowledge and threshold concepts can afford access to new ways of thinking, as the result of three stages - the ability to apply knowledge (with understanding), engagement with that knowledge, and awareness of where it is relevant (Perkins, 2008, p. 13). The differing aspects for discussion are outlined in Figure 33.

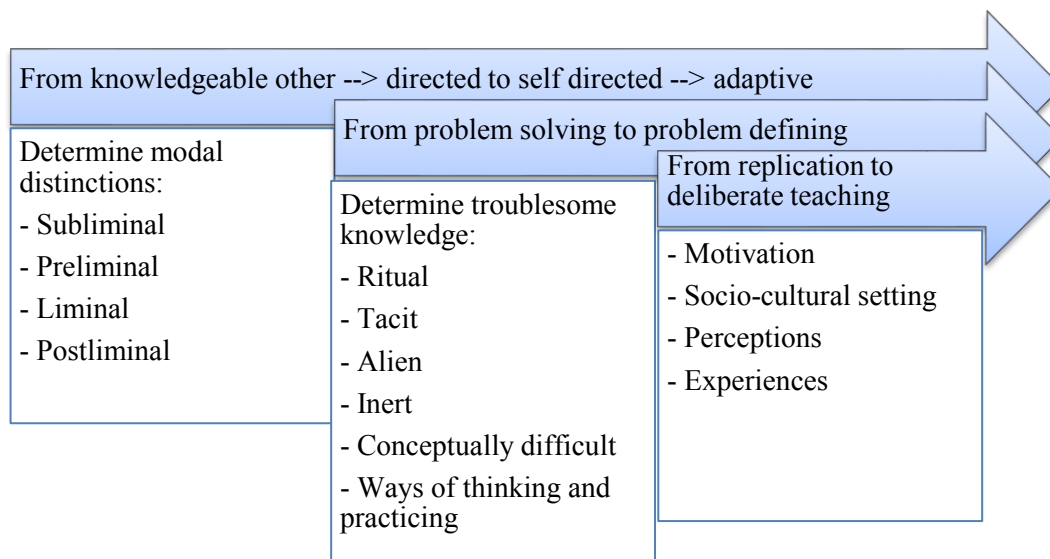


Figure 33. The application of technological concepts

Adapted from Perkins (2008), Meyer & Land (2006), Meyer, et al., (2008)

Figure 33 outlines ways to understand how we can support teachers to navigate the threshold concept identified in this research. The threshold concept is centred on how practitioners make meaning of the curriculum for their evolving knowledge for practice. During professional learning and to enable a sustained change in practice, teacher positioning needs to be established in relation to both their perception of the purpose of technology and understanding of the differing ways that they can explicitly teach the technological concepts. Teachers should be exposed to activities that encourage them to form connections between the differing concepts and to be able to articulate their purpose and meaning for their learners. The following professional learning model is designed to support and model self-regulatory approaches to facilitate this process. The intention is that teachers will foster greater autonomy with their professional learning as it occurs, towards becoming adaptive practitioners.

6.8.2 Enabling the professional learning

With the introduction of new professional standards, there is likely to be some unease within the educational community in New Zealand. The proposed model is designed to focus on five of the six professional standards and is intended to

provide a framework that can address a disparity between technology teachers' theory and practice.

6.8.2.1 Self-assessment and goal setting task: Teachers' perceptions

As the Co-ordinator of the Teacher Education Refresh Programme (University of Waikato, 2013 - 2017) I have seen the benefit of teachers' reflecting upon their practice and setting their own future goals. Teachers in this programme were often (initially) resistant to engage with their professional learning, but could see the potential for identifying goals for their own practice and take ownership for their own development. Goal-setting tasks can make teachers more motivated to succeed and develop their self - because they could direct their own pathway for learning efficacy (Zimmerman, Bandura, & Martinez-Pons, 1992). When setting a goal, the level of difficulty can also be reciprocated by the success that results (Phillips & Gully, 1997). It is also beneficial for a learner however to have links made to the context within which their practice will be realised (Latham & Yukl, 1975; Locke, 1975; Pajares, 1996; Steers & Porter, 1974). By encouraging teachers' to become self-regulating during professional learning experiences, they are more likely to critically analyse their performance in a meaningful and sustained way (Shunk, 1990). This model encourages self-analysis, self-reflection and self-observation (of emerging practices) with a view to develop self-efficacy - the belief that one can succeed.

Throughout the professional learning process, it is proposed that an external mentor can initially provide feedback about the teacher's practice, to empower the individual (as necessary) to become self-regulating and to critically analyse their thinking, and reflect upon their motivation and externally manifesting behaviours (Pintrich & Zusho, 2002). Teachers should be encouraged to regularly reflect upon their learning goals and the strategies and management of resources that enable their development, as well as the pedagogical outcomes they achieve (Nicol & Macfarlane-Dick, 2006). This process can be evidenced or substantiated through planning processes, and then self-reported.

6.8.2.2 Determining curriculum understandings

To honour the intent of the curriculum, teachers' understandings during this professional learning process should be determined through constructivist means.

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According to Brooks and Brooks (1993) there are four principles that align with a constructivist approach to learning including

- Seeking and valuing the learners' point of view
- Challenging learners' suppositions and either validating or transforming their truths
- Discussing emerging issues or relevance of the learning to support the creation of personal meaning
- Contextualising the learning to focus on the bigger picture, with mediation from the more knowledgeable other (p. ix).

As with any learning, this process is not intended to be linear in nature and teachers should be provided with the autonomy to choose interventions that suit them. To establish teachers' understandings of technology education, discussion about their practice will generate information about how they use the technological concepts to inform their teaching. If teachers' understand the purpose of learning as it is conceived in the technology education curriculum (MoE, 2007, 2016), they are more likely to design deliberate interventions, and apply their understandings within different learning contexts (Wiggins & McTighe, 2006). This is pertinent because the research findings indicated that there was a tension for some technology teachers who were experiencing difficulty transferring their understanding of the technology curriculum for enactment in differing learning contexts. Without this knowledge, teachers are more likely to default to a process-driven model and less likely to engage with the curriculum in an intentional or future-focused manner (Wiggins & McTighe, 2006).

To establish teachers' understandings of the technological concepts, questions should be based upon previous experience about how they teach concepts (like the Characteristics of Technological Outcomes). Teachers' knowledge can then be determined to establish gaps in understanding, in light of the recommended learning progressions within the subject's supporting documentation (MoE, 2007, 2010). Such a model uses the Just in Time approach to teaching (Novak, 2011; Osmond & Goodnough, 2011) and recognises that new knowledge is more likely to be retained because it is valued, timely and relevant (Kariuki & Duran, 2004). This model can also be transferred into an Initial Teacher Education setting, when

students enter the University with a diverse range of perceptions about the nature of technology education. This notion is discussed further in Chapter seven.

6.8.2.3 Co-constructing new understandings

Having established teachers’ knowledge of the technological concepts in the curriculum, they will be offered the opportunity to engage with anchored instruction, to explore a future-focused issue of their choice, within a simulated environment. The intention is that by experiencing the learning themselves, they are more likely to see the benefits of such an approach in their own classroom. Anchored instruction can model Just in Time approaches to learning, to foster understanding of a new concept in a differentiated manner, and acknowledge teachers’ perceptions and previous experiences (Bransford, Sherwood, Hasselbring, Kinzer, & Williams, 1990).

The stages of anchored instruction can be aligned with the expectation that a teacher will take increasing ownership of their professional learning, as it progresses. According to Baumbach, Brewer, and Bird (1995) there are six key decision making points that can define anchored instruction. These are represented in Figure 34, and are proposed as a means to support technology teachers’ evolving pedagogies.

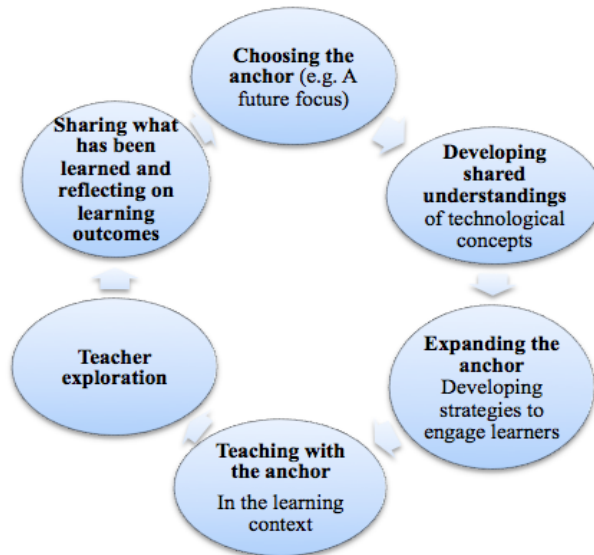


Figure 34. A model to support teachers’ understandings

Adapted from Baumbach, et al., (1995) key stages of anchored instruction

The “anchor” in this context will be negotiated with the teacher, based on what they know, find troublesome, or wish to explore further. This part of the professional learning could be individual or collaboratively agreed upon. For example, in Greenhill School, students focused each term on a school based learning theme, such as “Impact”. In this context, teachers could seek to explore a theme that manifested differently in each specialist area of technology, and addressed particular technological concepts. Professional learning could begin with some inquiry questions as illustrated in Figure 35, to prompt teachers’ thinking, and guidance would be provided during the initial planning stages.

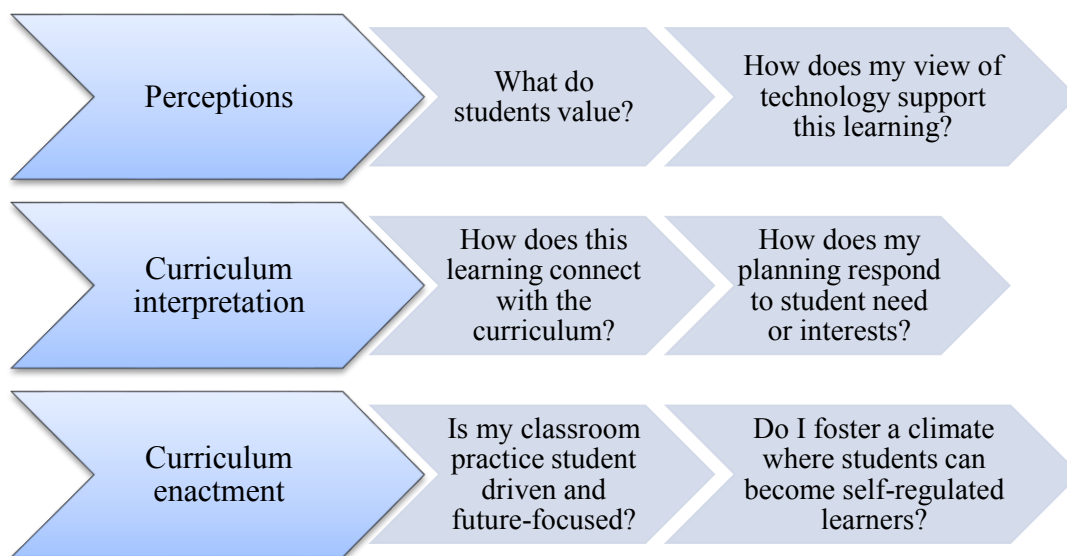


Figure 35. Questions to support teacher inquiry

This phase of professional learning encourages teachers to consider whether their espoused theories and practice align and aims to guide reflection about how they could adapt their practice, or facilitate learner-centred approaches to pedagogy.

6.8.2.4 *Applying theory in practice: Learner-centred approaches*

Whilst all of the participants in this research perceived that (on some level) they were responding to their students’ interests, there were few examples where learner-centred pedagogies were being used to effect, or in agentic ways. To facilitate learner-centred pedagogies in technology, teachers need to engage in deliberate planning, to encompass the technological concepts, as appropriate. Teaching can accommodate a range of experiential strategies that support different approaches to learning and provide flexibility to allow conversations, which focus on conceptual understandings in technology education, not solely the

knowledge informing the development of practical outcomes (Cornelius & Gordon, 2008; Wright, 2011). Collaboration between learner and teacher should be encouraged, to respond to student need (Jones, 2007; Weimer, 2002, 2012). This way, a teacher is more likely to position the learner to take responsibility for their own learning (Weimer, 2002). To model the creative and critical skills and knowledge required to be successful in a contemporary approach to technology education, teachers need to be motivated to explore and reflect upon learning in a variety of contexts to develop their knowledge, regardless of gaps in content or pedagogy (Niemic & Ryan, 2009).

6.9 Chapter Summary

This chapter discusses the emerging themes from the data and the key findings to describe the six technology teachers' perceptions, interpretation and enactment of the curriculum. It highlights that even when teachers are motivated to represent the technological concepts as they are conceived within the curriculum (MoE, 2007), there are often constraints to their practice.

Regardless of the nature of the organisational structures in schools, manifesting practice in technology education appears to be affected by community understandings and a pervasive attitude towards the production of quality outcomes, and teacher-centred pedagogies. The key themes from the findings indicate a need for teachers to review their perceptions of the nature of technology education. The nature of pedagogical practice was also discussed in reference to a need to develop student-centred learning opportunities that foster creative, critical, and problem-solving capabilities alongside the necessary skills and knowledge required to be successful in a contemporary approach to technology education. Regardless of teachers' engagement with the technology curriculum to date, there is the continuing need for them to continue to engage with professional learning, in order to develop their capacity for responsive and future-focused approaches to pedagogy (Ferguson, 2010; Jones, 2003, 2009; Jones, et al., 2013; Williams, 2013; Williams & Lockley, 2012). Chapter seven will discuss the key conclusions and recommendations as a result of this discussion.

CHAPTER SEVEN: CONCLUSIONS AND RECOMMENDATIONS

7.1 Introduction

In this qualitative research study I explored the disparity between the intent of the technology curriculum and the practice of six teachers in two school contexts. I investigated how the discourse in a school, and teachers' perceptions of the purpose of technology education influenced both their engagement with the curriculum as well as its enactment. I explored the ways in which teachers navigated their practice, to enact the technology curriculum, as it is presented within the New Zealand curriculum (MoE, 2007). This provided new insights to the aspects of the technology curriculum that teachers are finding "troublesome" and to identify ways to develop practitioners' thinking and enable a change in practice.

In technology education, government funding has reflected a tension in its priorities with recent emphasis being on trades pathways rather than technological innovation. When aligned with the diversity of teachers' perceptions about the nature and purpose of technology education, the subject reflects a confused identity with some teachers reverting to historically placed practices, which are technical in nature. This chapter presents conclusions from the research data, which are pertinent not just for technology teachers but for any professional who is experiencing difficulty navigating a disparity between educational theory and practice. The implications of this research are discussed in light of my own professional practice when working with pre-service secondary Graduate and Master students in the Initial Teacher Education Programme at the University of Waikato. Assertions are made about the necessary changes in thinking and practice required for secondary teachers of technology who are motivated to navigate the challenges that they are likely to experience in their schools and recommendations are presented. Limitations to the study are discussed before the summary.

7.2 The implications of the research

This research contributes to both methodological and empirical knowledge. Methodologically, I combined the activity and threshold concept theory in an

innovative manner to gain deeper insight into the curriculum knowledge that six technology teachers found troublesome. Activity theory was used as the interpretive framework and threshold concept theory was a means to conceptualise how teachers could enable a transformation in both thinking and practice in technology education. In particular, the notion of liminality was used to determine how teachers' perceptions and knowledge of the curriculum were conceived and influenced by their experiences and professional learning context. Such an approach is transferable to my own practice, when I teach Graduates and Masters of Education students about curriculum and pedagogy.

This research contributes to empirical knowledge because it highlights that whilst teachers may perceive they are enacting the curriculum in a contemporary manner, their previous experiences are also likely to be communicating technical approaches to the subject. There are persisting tensions moderating a change in technology teachers' practice, which need to be addressed before the subject can be enacted as it has been conceived in the New Zealand Curriculum (MoE, 2007; 2017b). This research has highlighted implications for Initial Teacher Education Programmes in New Zealand, which are discussed next.

7.2.1 Implications for Initial Teacher Education programmes

At the University of Waikato, graduates in technology education can enter the Diploma Programme with a university degree, or as a direct result of their work experience in the Trades. Inevitably, student teachers make assumptions about the nature of technology education, which appear to be based on the knowledge that they value. As a result, the first technology curriculum paper commences with a focus on supporting students' understanding of the nature of technology education in the school context and the potential implications for their future practice.

In my experience, a focus on the nature of technology education at the beginning of the Initial Teacher Education programme is sometimes criticised by practitioners in secondary schools, who want student teachers to have well-established specialised content knowledge and an understanding of the NCEA to apply during their school-based experiences. Whilst such factors are likely to be important to a practitioner's evolving pedagogical practice, my research indicates that student teachers of technology must first develop a contemporary understanding of the curriculum to make meaning of it for their future practice

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and so that they can interpret the nature of the pedagogies that they observe in schools. In short, there is a disparity between what teachers believe students need and what academic researchers assert is important in contemporary education.

As a result of this research, Secondary Graduate Diploma and Masters technology students will experience a revised programme in 2018. It will introduce ideas related to how technology education has evolved, but will also emphasise the importance of student-centred and digital pedagogies, to encourage critical and creative approaches to technological thinking. Whilst my curriculum papers have previously included a focus on interpreting the curriculum concepts, further attention will be paid to the ways in which teachers can develop technologically fluent learners.

It is important for student teachers to understand the implications of the dual professional role that continues to be aligned with the subject - defined in this thesis as a technical and/or technological approach to technology education. In our revised programme, student teachers will focus on what defines technological innovation by investigating a technologist's work and then interpret and establish connections with the published national curriculum. This will provide students with practical experience when identifying a learning context in schools and to help them confidence in fulfilling their professional responsibilities to adhere to the curriculum.

Throughout the year, students will also be expected to realise some form of technological concept or outcome, to understand how it can be adapted according to different socio-cultural circumstances, and in response to an identified issue. An example could be for students to find alternative uses for the bi-products generated as the result of human consumption - such as coffee grinds. Such thinking is significant because it will encourage students' engagement in the Nature of Technology strand of the curriculum and will require them to problem-solve and conceptualise or develop innovative technological responses. This activity models an approach to pedagogy that is learner-centred and future-focused in nature. The specialist knowledge that student teachers hold is not the primary concern. Students will encounter troublesome knowledge and need to transition through liminal space, to develop new understanding at a time that is meaningful for them (Just in time). This learning will be situated as part of the

iterative process of technological development. This will be helpful in positioning student teachers to be able to apply their curriculum understandings to a range of learning contexts.

7.2.2 Implications for technology teachers' pedagogical practice

The revision of the technology curriculum in New Zealand (MoE, 2017b) presents an opportunity to re-position and raise awareness of the contemporary nature of technology education in schools. This research identified a disparity in what teachers' espouse they do and what they actually do in practice. Achieving common understanding about what technology education is, and helping teachers understand their responsibility in teaching the subject in a manner that aligns with the curriculum is critical. Whilst some teachers might be familiar with the curriculum, this research has illustrated that there is a gap in knowledge or motivation about how to translate it into their pedagogical practice, in a contemporary and organised manner. This is significant because it indicates that the cultural and historical nature of technology education continues to affect teachers' practice in implicit ways. Also important is how teachers manage their practice to maximise the time available to them. To enable change, I assert that there is a need to reject external professional learning models that are transmissive and focus on the accumulation of knowledge (Graham et al., 2006; Grimmett & MacKinnon, 1992; Tanner & Tanner, 1990; van Driel, et al., 2000; Zeichner, 1986). Collaborative partnerships for professional learning and increased accountability for teachers' enactment of the curriculum are necessary to mitigate a continuation of the status quo. This can be achieved through professional learning that is inquiry based, personalised holistic, reflective, and progressive in nature (Darling-Hammond & Richardson, 2009; Frank et al., 2010; Hargreaves & Fullan, 2012; Hollins et al., 2004; Leung, 2002; Sharp, et al., 2017; Sprinthall, et al., 1996; Zeichner, 1986).

This research has highlighted that to enable a future-focused approach to curriculum, technology teachers must appreciate the benefits of learner-centred pedagogies, commit to their enactment and sustain such practice. Such an approach will require them to be responsive to, and facilitate the development of knowledge and skills through an iterative approach to technology education - and sometimes "on the fly" in the classroom. This change will also be dependent upon

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practitioners having the confidence, motivation, knowledge, or interest in accommodating a range of differing learning opportunities from a variety of disciplines and in response to students' interests. Technology teachers' will need to appreciate that students are more likely to engage purposefully in their learning if opportunities are focused on their interests or if they are involved in the decision-making processes about their learning.

The review of the technology curriculum provides an opportunity to conceive pedagogy differently and re-position students' learning so that it can be inclusive of creative, innovative, and critical thinking approaches in a more purposeful manner. I acknowledge that to develop innovative technological outcomes, students need to understand the nature of materials or systems and be exposed to experiences where they can manipulate and adapt resources to represent or realise their ideas. Technology education, therefore, should be providing the opportunity for students to explore potential (conceptual, partially modelled or digitally realised) outcomes rather than solely emphasise the replication of existing thinking or products. This finding has been perceived as significant by the University of Waikato, which has provided Strategic Investment Funding to enable my further research.

To prepare students for a technologically-mediated future, some teachers will need to transform both their thinking and practice to engage with contemporary technological issues rather than limit classroom practice to accommodate their own existing skills or understandings. It is critical that school-based or external professional learning centre on the key curriculum concepts that technology teachers *need to know* and *how to teach* them in a future-orientated way.

One possible way to address this would be for professional learning models to be increasingly personalised and responsive to a teachers' stage of liminality. To develop common understanding of the curriculum, there needs to be a commitment to make meaning of the concepts in a school community in a co-ordinated manner. Such an approach is more likely to provide students with exposure to all three strands of the curriculum, at increasingly challenging levels, and for their application in a range of diverse learning contexts. If teachers make meaning of the curriculum in isolation and solely based on their current understandings or past experiences, there is a risk that their practice will not offer

the diversity of pedagogical approaches required to be responsive to students' evolving learning needs. By developing professional learning models that offer a range of views about how the technology curriculum can be interpreted and then translated into practice, this shortcoming could be addressed. I have proposed a professional learning model in Section 6.8, which advocates a partnership between technology teachers and representatives from the University of Waikato to support such evolving understandings. The next section of this chapter explains the limitations of the research and proposes strategies for the school community, moving towards a future-focused curriculum.

7.3 Research limitations

The research was limited to two schools and included data from six participants. Whilst the findings could be interpreted to present a deficit view of the subject, its intention was to report participants' views and practice in their schools, with a view to develop a professional learning model to support teachers' future-focused and evolving practice.

It is acknowledged that the nature of the learning observed in Greenhill School was also determined by the time of year that the data collection occurred, which was Term 1. It is common practice in the teaching community at the start of the year to emphasise routine, establish classroom expectations, and foster relationships. This limitation was mitigated through the triangulation of data sources. The time of year did not undermine the importance of my results, but was acknowledged when reporting my observations at Greenhill School. The next section summarises the final chapter.

7.4 Summary

This final thesis chapter considered the wider implications of this research. Specifically, the profession is facing another challenge - the move from traditionally placed pedagogies to those that are inclusive of digital technology, innovative in nature and aimed to respond to students' evolving academic and social needs. Whilst for some teachers, this will be an easy transition, for others there is likely to be a need to review their practice.

This thesis represents six technology teachers' perceptions, in two different secondary schools. It provides insight into their perceptions about the purpose of

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education, their conceptions of technology education, and the ways that they teach and work. There are diverse findings but particularly poignant is that innovative teaching does not need to be constrained to new and purposefully designed environments - as is sometimes assumed. Significantly, this research identifies that whilst a technology teacher might have extensive specialist knowledge, this does not necessarily translate to an understanding or engagement with the curriculum, or contemporary understanding of pedagogical approaches, to engage learners. The recent change in the New Zealand curriculum (MoE, 2007) presents new and exciting opportunities for technology education to lead the enactment of future-focused curriculum. To enable this change it is critical that teachers are empowered through professional learning, to become adaptive practitioners. In such a climate, it is imperative that secondary technology teachers are motivated to foster a classroom environment where students are supported to become self-regulating and develop innovative responses in a technologically mediated world.

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APPENDICES

Appendix A: Participant information sheet

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THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

Information sheet for participants: Semi structured interviews

Research: Exploring technology teachers' perceptions: A case study into the enactment of the New Zealand national curriculum.

Thank you for agreeing to partake in two interviews during 2015. During our conversations, you will be asked to reflect upon your teaching of technology education, as per the outlined themes below. This will be at a negotiated time and place that suits us both. The rationale here is to generate understanding about how your background, experience, values and perceptions of the nature and purpose of technology education in New Zealand impacts on your evolving practices.

Interview question schedule:

You may wish to make some notes in the space below, in preparation for the interview.

Overarching question: How do your perceptions about technology education influence your interpretation and enactment of the New Zealand curriculum?	
Do you think there are any discrepancies between the intent of the New Zealand curriculum and the reality for your school context?	What are your thoughts about nature and place of technology education in New Zealand?
What do you think should be taught in technology? When? How?	What strategies have you used to Familiarise yourself with the curriculum, Develop resources, Keep your teaching current?

FOLLOW UP INTERVIEW QUESTIONS:

- 1) Have you identified any further discrepancies between the intent of the New Zealand curriculum and the reality for your school context this year?
- 2) Have you any new thoughts about the nature and place of technology education in New Zealand?

APPENDICES

- 3) In light of your engagement with this years professional development, have you changed your thinking about what do should be taught in technology, when and how?
- 4) What strategies have you used this year to further familiarise yourself with the curriculum, develop resources and keep your teaching current?

Appendix B: Lesson observation sheet

Research: Exploring technology teachers' perceptions: A case study into the enactment of the New Zealand national curriculum.

Date of lesson observation:		Class level:	
Pseudonym:		NZC level/s:	
NZC Achievement Objective and focus of the lesson:			
Description of activity:			
Technological terminology used and frequency (supporting resources attached):			
Category	Indicators	Considerations	Researcher (anecdotal) notes
Verbal behaviour and interactions	Who speaks to whom? For how long? Who initiates interactions? Tone of voice?	Gender Age Ethnicity Professional position in the department or school Dynamics of the interactions	
Physical behaviour and gestures	What does the teacher do during the stages of the lesson, who does the teacher interact with, who is not interacting with the teacher?	How people use their bodies and voices to communicate, what behaviours indicate about relationships, social rank or professional status	
Students who are noticed	Which students receive considerable attention, which don't?	What are their individual's characteristics? What makes them different from the rest of the class?	
Record of teacher dialogue			

APPENDICES

Appendix C: Approval for extension to research ethics

Dean's Office
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The University of Waikato
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THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

MEMORANDUM

To: Elizabeth Reinsfield
cc: Professor John Williams
From: Dr Carl Mika
Chairperson (Acting), Research Ethics Committee
Date: 22 October 2015
Subject: Request for Extension to Research Ethics Approval – Student (EDU008/15)

Thank you for your request for an extension to ethics approval for the project:

**Exploring technology teachers' perceptions:
A case study into the enactment of the New Zealand national curriculum**

It is noted that you wish to include another school to participate in your research project and have extended the data collection timetable accordingly. Thank you for supplying the revised participant information letters and consent forms.

I am pleased to advise that your application has received approval.

Please note that researchers are asked to consult with the Faculty's Research Ethics Committee in the first instance if any further changes to the approved research design are proposed.

The Committee wishes you all the best with your research.

Dr Carl Mika
Chairperson (Acting)
Research Ethics Committee

APPENDICES

Appendix D: Updated application for ethical approval

APPLICATION FOR ETHICAL APPROVAL OF SUPERVISED GRADUATE/POSTGRADUATE RESEARCH PROJECTS

The purpose of this form is to give the Faculty of Education Research Ethics Committee sufficient information to make an informed judgment about the ethics of your application.

Applications should be **typed**. Please ensure that you have read the University of Waikato's *Ethical Conduct in Human Research and Related Activities Regulations 2008* which can be found at:

<http://calendar.waikato.ac.nz/assessment/ethicalConduct.html><http://calendar.waikato.ac.nz/assessment/ethicalConduct.html>

Date of Submission: 2 February 2015

Please indicate if this a new application or an extension of a previously submitted application: New

Name of Applicant: Elizabeth Reinsfield

Contact Address: 234 Frontier Road, Te Awamutu

Contact Phone Number: 0274492035

Contact E-mail: reinsl@waikato.ac.nz

Programme of study: PhD

Please specify the number of papers in your programme if applicable (e.g. MEd, PhD and if Masters state 1,2,3 or 4 paper equivalence).

Department, centre or unit: TEMS Education Research Centre
(*E.g., Arts and Language Education*).

Principal supervisor: John Williams

Your current qualifications: Bachelor of Education (Honours) Design and Technology; Masters in Education.

Your current employment: Co-ordinator of the Teacher Education Refresh Programme and academic mentor for the Master in teaching and learning at the University of Waikato.

Title of project: Exploring technology teachers' perceptions: A case study into the enactment of the New Zealand national curriculum.

Interest in topic:

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In a brief paragraph please explain your background or previous experience with this topic.

My interest in technology education has been persistent throughout my teaching career of over twenty years. Since graduating in the United Kingdom as a design and technology teacher, I have observed, been involved with and at times led the subject's transition from being practice based to include a more theoretical dimension. These experiences as a member of the technology education community have allowed me to appreciate the tensions that emerge for some practitioners who perceive that changes in curriculum are rapidly implemented, without consultation and communicated in a manner that are difficult to understand (Bondy, 2007). My Masters research consisted of a case study into the drivers for curriculum innovation in technology education within a secondary school context. My role at the University of Waikato has enabled various conversations with technology teachers who indicate that they continue to find the terminology and some of the concepts within the curriculum difficult to engage with. This led to my writing two 'Technology to go' books (Reinsfield, 2014; 2015). The writing of these books required significant reflection in terms of how to navigate the tensions between curriculum intent, mandated requirements and the influence of teachers' perceptions on their enactment of technology education. The culmination of my own experiences and practice as well as that of others has deepened my interest in this topic.

Other personnel or agencies involved: One local secondary school
E.g. Ministry of Education, An educational or social institution etc. (or N/A).

1. Details of the Project

a) Research question(s) and relevance:

Include the overarching research question(s) that will guide your research.

How do technology teachers' perceptions influence their enactment of the New Zealand curriculum?

- i. What educational ideas are represented in the mandated curriculum for technology education in New Zealand?
- ii. How did the curriculum emerge, how has it changed, developed or reinforced the dominant discourse?
- iii. How does policy reinforce or reproduce or reject social injustices?
- iv. What are the teachers' understanding of the nature and place of technology education in New Zealand and how do they explain their practice?
- v. How can teaching as inquiry encourage teacher agency within schools?

The research will be an inductive process, connecting the research questions with the generation of understanding about the themes, which emerge out of the data (Patton, 2002).

b) A brief paragraph, including references to literature explaining the relevance or importance of the knowledge to be gained.

In order to better understand the phenomenon of technology teaching in New Zealand, it is important to consider the historical context, the role of the teacher, their differing ideologies and how teacher perceptions are mirrored through their pedagogical practice. For example, the first (supporting) question intends to generate understanding about the political drivers for technology education and the philosophy underpinning the curriculum policy documents.

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The topic of research considers the potential for self-emancipatory professional learning within technology education in the New Zealand context, from a social constructivist perspective (Biddulph & Carr, 1999; Lodico, Spaulding & Voegtle, 2006). It provides an opportunity to generate knowledge about how historical and cultural factors have influenced the development of curriculum content, teacher and community perspectives around the purpose of technology education, its enactment in the classroom as well as the tensions around teacher engagement with current professional development practices.

Perceptions towards knowledge are highly pertinent for teachers of technology education where historical perceptions of the purpose of the subject continue to influence its enactment (Jones, 2009; Williams, 2012; Williams & Lockley, 2012). From a research perspective, the knowledge generated will be local and will aim to connect any perceived divisions between knowledge *for* practice and knowledge *of* practice (Cochran-Smith & Smythe, 2009) particularly when describing the benefits of collaborative and inquiry based professional development in technology education (Menter et al., 2011). It is intended to unpack further, the views of Jones, Bunting and de Vries (2013) who acknowledge that technology education is now more readily accepted as a discipline within New Zealand schools but who also state that there is continued need for action research where the focus is on the teacher and how their understandings get translated *into* practice.

The notion of pedagogical knowledge, defined by Hume, Eames, Williams and Lockley (2013) as “a term to describe the specialised form of professional knowledge that teachers use to create rich learning opportunities” (p. 34) is conceptualised as a ‘content representation’ [CoRe] and can accommodate the variables within technology education (Williams, 2013) in a secondary school context. This is particularly pertinent within technology education where there are many different subject specialisms (such as textiles or hard materials), meaning that teachers are required to contextualise generic technology concepts by drawing upon their own understandings.

In conclusion, the research proposes to generate understanding about how shared pedagogical and content knowledge can be collaboratively constructed within a secondary school, department setting. Through professional development processes which encourage personalised reflection and engagement with the curriculum, understanding will be gained around how interpret and enact the curriculum.

c) Procedure for recruiting participants

Ensure the criteria for selecting participants is clear, and detail how they will be recruited

Specify (approximately) how many participants will be recruited.

The first case school have been purposefully selected because the new faculty head wishes to lead his staff collaboratively through a period of transition to enable them to co-construct knowledge and shared understandings of the nature and purpose of the technology curriculum. There are 7 teachers in the department, and they will be asked to volunteer to partake in the research.

The second school is opening in 2016 and provides the opportunity to look at the teacher’s planning from an alternative perspective to the first school. There are three teachers in the department who will be asked to volunteer to partake in the research.

To make the research more manageable, the participants will be based in two local schools, two departments and close to my workplace. Upon meeting the teachers for the first time, I will provide them with an overview of the research intent and allow the

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opportunity for any questions before issuing the informed consent forms. Within the informed consent forms, I will include information about the research process, as well as the semi-structured interview questions (See Appendices 1, 2 & 3). The protocol will include the receipt of signed informed consent forms before proposed interview dates are negotiated, including the issuing of a brief script to identify the purpose of the study as well as the preliminary questions to elicit information and be the starting point for our dialogue (Creswell, 2012; Menter et al., 2011). Participation in the research will be voluntary. All teachers in the department will be informed they can decline to be involved if they do not wish to participate in the research. Participants may withdraw from the research at any time, their data can be withdrawn until the data analysis commences in December 2015. Participants can withdraw their contribution and data by contacting Liz Reinsfield by email or phone.

d) Procedures in which research participants will be involved

i) Indicate what activities you require participants to do in your study

What will participants be required to do? Be explicit, and remember to include the checking and amending of transcripts if this is relevant to your project.

ii) Indicate how much participants' time will be required

Please provide a good estimate of participants' time commitment. Remember to include time for checking transcripts if this is relevant to your study.

Data generation task	Breakdown of time	Researcher observation time of school based events	Participants' actual time for the research
Two semi-structured interviews	No longer than forty minutes in duration for each interview, plus time to read and provide any necessary comment to ensure that that the transcript is a true representation of events.	N/A	Approximately two and a half hours.
Department meetings	Department meetings, which focus on curriculum are monthly and last about one and a half hours. The data generation will be from February to November.	One professional meeting each month for the school year. Approximately fifteen hours of observation time.	Five hours for checking transcripts.
Sharing of teacher made resources	These resources can be shared during or after department meeting time and will be a natural part of the teachers practice.	N/A	Approximately one hour over the data generation time to select and provide teacher made resources.
Self-report (Diary cam)	Twenty minutes after each department meeting or any other time that the participant has something pertinent to share as part of the research.	N/A	Approximately three and half hours throughout the ten month period.
Two lesson observations	One lesson observation at the beginning and one at the end of the	Approximately two hours of	One hour for checking the

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	process.	lesson time observed per participant.	transcript of teacher dialogue.
Final report	Checking of the report to ensure that it is a true representation of events and, as far as possible, maintains the confidentiality of the participants.	N/A	Approximately one hour.
Please note that the observation of activities involve directed teacher contact time or professional development and as such do not require any additional preparation or contribution to the research.		15 hours observing meetings and 14 hours observing lessons.	14 hours.

Please attach copies of any questionnaires, interview schedules, observation processes, collection of work samples etc. as appendices, and make reference to them here.

e) Procedures for handling information and materials produced in the course of the research. (Must be kept for five years)

As per the University's Ethical Conduct in Human Research and Related Activities Regulations (2008) all non-identifying data (e.g. data sets and transcripts) used for publication must be securely kept long enough to allow for academic examination, challenge, or peer review. This period would normally be at least five years. Identifying data such as consent forms, photographs, and videos will be securely stored consistent with agreements made under section 9(4)(a) of these regulations. This normally means being stored in a secure location (e.g. password protected computer or locked cabinet). The responsibility for data storage lies with the department or other equivalent academic unit.

All non-identifying data (such as the transcripts) used for publication will be securely kept for five years to allow for academic examination, challenge or peer review. Identifying data (such as the consent forms) will be securely stored consistent with the agreements made under section 9(4)(a) of the Ethical Conduct in Human research and Related Activities Regulations (2008). All information and materials will be kept securely in the researcher's office. Access to the data and information collected will be restricted to myself and my supervisors. Data will be kept for a period of at least five years.

2. Ethical Issues

Discuss possible ethical concerns under the following headings. Describe procedures adopted to ensure ethical conduct of the research in sufficient detail for them to be evaluated by the Research Ethics Committee.

Acknowledge potential problems which cannot be entirely eliminated and describe procedures for minimising risk.

a) Access to participants

Are you in normal contact with potential participants or do you have to ask for permission (e.g. from parents, school principal)? Note that it is the Principal's responsibility to inform Boards of Trustees about your proposed research. You cannot assume you have access to potential participants or to a database for research purposes.

Once approval has been granted by University of Waikato Ethics Committee, the Principal of the school will be approached for informed consent (Appendix 1). The school has been purposefully selected because of its established relationship with the

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University, its location as well as the diversity of staff represented within the technology education department.

Only when the research has been approved by the school will I approach the head of department and teachers. I will attend a department meeting and explain the purpose of the research. Participants will be asked to take part in the research voluntarily and will be advised that they can withdraw at any time throughout the research (see Appendix 1, 2 & 3).

b) Informed consent

If you are dealing with adults or older children, tell us how you will gain their informed consent (e.g. in a covering letter that tells them about the project, and an informed consent form). If you are dealing with young children you will need to seek informed consent from parents/caregivers/school principal. If children are involved as participants, remember to include an Informed Consent Form for the children and ensure it is written using language children will understand, or describe verbal assent processes.

Please attach copies of any introductory letters, information sheets and consent forms as appendices, and make reference to them here.

The Principal of the school will be approached for informed consent (Appendix 1). This form includes information about the research as well as explaining the parameters for the data generation. It explains that the participants can withdraw their participation at any time as well as the procedures to protect the school and teachers confidentiality.

Upon meeting the teachers for the first time, I will provide them with an overview of the research intent and allow the opportunity for questions before issuing the informed consent forms. In addition to the informed consent forms, I will include information about the research process, as well as the semi-structured interview questions (Appendix 3, 4 & 5). The protocol will include the receipt of signed informed consent forms before the interview date, which includes a brief script to identify the purpose of the study as well as the preliminary questions to elicit information and to be the starting point for our dialogue (Creswell, 2012).

c) Anonymity/ Confidentiality

Anonymity: *How are you going to safeguard participants' identity? By using codes? By using pseudonyms? Or by other means?*

Confidentiality: *Indicate how data and information will be kept private. Consider that although participants' identities may be protected, the data shared will not remain confidential since it is reported in the project. Include a statement to this effect in the information sheets and informed consent, such as "While every effort will be made to ensure confidentiality, this can not be guaranteed".*

I consider myself as having a duty of care to protect the identities of the participants and the school. Menter et al., (2011) advocate for a research process which

...observes protocols, involves participants, reports progress, obtains authorisation from the necessary parties, accepts responsibility for maintaining confidentiality, retains documentation and make procedure transparent and understood (p. 64).

The main ethical issues within this research relate to informed consent and freedom from coercion, voluntary participation, confidentiality and data access and storage. Where feasible and as far as possible, any risk of identifying participants will be minimised by ensuring that names and personal details are never disclosed. Pseudonyms will be used in

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the reporting of findings. However, it is acknowledged that as I am only researching in one school, there is the likelihood that participants will be recognisable to each other in the final research report.

d) Potential harm to participants

Participants must not be coerced into the study. Identify any power relationships that might exist. If potential harm of any sort could occur to participants, outline the nature of this, and how it will be mitigated.

It is possible that some of the teachers will be anxious about their participation within this research, particularly as both departments have a new head of faculty. The initial introduction to the research will aim to actively encourage participation and allay personal reservations around confidentiality. I will explain that I am not there to judge the quality of their practice but instead to acknowledge that there are many perceptions towards the enactment of technology education.

I will therefore be explicit in my disclosure that I am keen to encourage a range of participants who represent the differing technological areas (such as food or electronics), teacher characteristics and attitudes towards technology education. I will be clear that the intention of the report to the school at the end of the process is to provide feedback about the observed professional development processes as well as any recommendations around future practice. I will re-iterate that any concerns about the research process can be shared with myself or my supervisors.

I acknowledge that the time involved represents a commitment for teachers and could be perceived as onerous. I am sensitive to this time commitment and will be flexible and accommodating when scheduling interview times with the participants.

e) Participants' right to decline to participate and right to withdraw/withdraw data

Participants must have the right to withdraw from the study at anytime and their data up until a certain point (e.g., up until they have approved their transcripts or data analysis commences). If participants are going to be involved in a focus group interview, specify that they will not be able to review or withdraw any of the data they contribute to the focus group discussion. Please ensure these points are clear in all participant information sheets and informed consent forms.

All teachers within the technology department will be invited to participate in the research and can decline if they do not want to be involved. Once participants within the research, they will have the right to withdraw their contribution at any time, and their data, until its analysis commences. If participants have not advised the researchers that they wish to withdraw, it will be assumed that they have viewed and agreed to the use of their contributions in the research. Participants can withdraw by contacting the researcher by email.

f) Arrangements for participants to receive information

How will you keep participants informed about the work and/or its results? State that participants will get the opportunity to review, amend and approve their data (e.g. transcripts of interviews). They should also be advised of where they might access outcomes from the study upon its completion (e.g. Research Commons).

Participants will be sent transcripts of the semi-structured interviews, lesson observations and self-report dialogue via their selected email. Department meeting transcripts will be generic because they are local data and will be sent via a group email. If participants do

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not provide feedback about the transcribed material within the timeframe suggested, it will be assumed that they consider it a true representation of events.

g) Use of the information

Specify what the information will be used for (e.g. in the thesis/dissertation and other scholarly publications and/or presentations). You do not have the right to use the information for purposes other than your research as specified here without going back to participants and seeking further consent, or including information about other possible uses on information and consent forms.

The primary use of the data collected will be for my PhD thesis and may be used in seminars and/or conference presentations, publications and research reports. This is identified on the information provided within the consent forms (See Appendix 1 & 2)

h) Conflicts of interest

Show that you have carefully considered any potential conflicts of interest that might arise. Will you be in a position of assessing students, have authority over staff? Do you have a professional relationship with participants or their teachers or families? If so, indicate how potential conflicts of interest will be mitigated.

In the first school, I will acknowledge that I have worked with the head of faculty as part of the Beacon Practice project. In the second, I will acknowledge my previous working relationship with one of the potential participants. This may present some initial concern for the other participants. I will reiterate that I am there to observe all participants however and that all data is confidential to myself and my supervisors and that their identities will be protected as far as possible. I will make sure that they understand that their data will not be discussed with other participants.

i) Procedure for resolution of disputes

If a dispute arises, the researcher should be contacted in the first instance and should there be no resolution, then the supervisor may be contacted. Ensure that full contact details for your supervisor are provided on the letters of invitation and consent forms.

Should there be any concern or disputes throughout the research process, the Principal and participants will be advised that they can contact me in the first instance on 078384433 or reinsl@waikato.ac.nz. Should a dispute arise or if there are further concerns the relevant people will be provided the contact details for my supervisors Dr. John Williams and Dr. Dianne Forbes (See Appendix 1, 2 & 3).

j) Other ethical concerns relevant to the research

“N/A” if not applicable.

The means with which participants decide to share their self-report data will determine its level of confidentiality. The storage and collation of video clips is therefore pertinent here, in terms of whether participants choose to send them directly to me or store them online. This will be negotiated on an individual basis, with participants being informed that the videos are not intended for any other audience than myself and my supervisors. All downloaded electronic data will be stored in a password protected file on the computer in my university office.

k) Cultural and Social considerations

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Pay careful attention in contexts where your background as a researcher differs from that of participants, their families or their communities. Show that any potential cultural and social issues have been given careful consideration. State what the potential issues are and how they will be addressed. Indicate if you have approached a cultural advisor to help you address any potential cultural issues. If the social and cultural background of the participants is not known, please include a statement to the effect that the appropriate advice will be sought if social and cultural considerations become apparent during the research. Include the names and roles of specific personnel, if relevant.

The aim of this research is to generate understanding about how teachers view and position 'knowledge' when constructing meaning or enacting technology education. I will introduce myself in the first department meeting and describe my experiences in technology education. I will reassure the participants that the purpose of the research is to describe the context within which my observations are made and that the focus is on their perceptions and practice, not my own. Saying that, I will acknowledge that my own experiences will inform the data analysis stage of the research in order to recognise and identify themes.

3. Legal Issues

Outline legal issues which may arise in the course of this research under the following headings:

a) Copyright

It is usual to state that the researcher will hold the copyright of any scholarly publications produced from the research. (Also refer to the University Copyright Regulations.)

The researcher will hold copyright of any publications.

b) Ownership of data or materials produced

Specify that the participants will own their own raw data and the researcher will own the thesis/dissertation (whichever is applicable) and any scholarly publications and/or presentations that arise from it.

The raw data will remain the property of the participants who will have the right to withdraw from the research at any time. Participants have the right to withdraw their data until data analysis commences. The researcher owns the interpretation of the data and will be able to use it for any subsequent academic publications and/or presentations that may arise from the research.

c) Any other legal issue relevant to the research

"N/A" if not applicable.

N/A

d) Place in which the research will be conducted

A local secondary school.

e) Has this application in whole or part previously been declined or approved by another ethics committee?

"N/A" if not applicable.

N/A.

f) For research to be undertaken at other facilities under the control of another ethics committee, has an application also been made to that committee?

If you are working at a school or other tertiary institution and will be carrying out data collection you may need permission from another ethics committee. This may also apply to joint university research. "N/A" if not applicable.

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N/A.

g) Is any of this work being used in a thesis/dissertation to be submitted for a degree at the University of Waikato*

In the information to participants, state that an electronic copy of the thesis/dissertation will become widely available, as the University of Waikato requires that a digital copy of Masters, MPhil and Doctoral (select one) theses be lodged permanently in the University's digital repository: Research Commons. "N/A" if not applicable.

This work will be submitted as part of a PhD thesis.

h) Further conditions

"N/A" if not applicable.

N/A.

4. Research Timetable

Ensure you allow enough time for research ethics approval to be processed prior to the intended commencement of data collection.

a) Proposed date of commencement of data collection: March 2015

b) Expected date of completion of data collection: November 2015

5. Informing Relevant Departmental Chair/s

a) Is your proposed research about papers or programmes within the University of Waikato Faculty of Education?

Yes

b) If yes, have you informed the relevant Chair(s) of Department?

Yes

6. Applicant Agreement

I agree,

a) To ensure that the above-mentioned procedures concerning the ethical conduct of this project will be followed by all those involved in the collection and handling of data.

b) In the event of this application being approved, to inform the Faculty of Education Research Ethics Committee of any significant change subsequently proposed, such as to the research questions, participant groups, or data collection methods, affecting the direction of the research and necessitating new ethical consideration.

c) To submit for approval any amendments made to the research procedures outlined in this application, which affect the ethical appraisal of the project.

Please share this application with your principal supervisor prior to submission. His or her review and approval of this application is mandatory.

I confirm,

That this application has been reviewed by my principal supervisor, who has approved its submission.



7. Submission

Please email the application and appendices as **one single WORD document** to the Committee Administrator at: hayleys@waikato.ac.nz

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The deadlines for applications in 2014 are 5pm on:

28 Jan, 24 Feb, 24 Mar, 28 Apr, 26 May, 23 June, 28 Jul, 1 Sept, 6 Oct, 3 Nov and 1 Dec

8. Checklist

There should be no blanks on your application - ALL headings need to be addressed and ensure **all pages** are numbered.

Please ensure you have completed the following and attached these as appendices, where relevant to your application:

Letter(s) to: participants, e.g. children, caregivers, principal, teachers

Information sheet, introductory letter for each type of participant

Consent form(s) for each type of participant

~~Questionnaire/survey questions~~/interview questions

Reference list

PLEASE NOTE:

- Each appendix is to be set out on a separate page with the appendix number and research title included in the header.

-Typographical and grammatical inaccuracies are a major impediment to the processing of applications, particularly in documentation going out to participants. **PLEASE ENSURE YOU PROOFREAD YOUR APPLICATION AND APPENDICES THOROUGHLY TO ENABLE YOUR APPLICATION TO BE PROCESSED AS QUICKLY AS POSSIBLE.**

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Faculty of Education
Te Kura Toi Tangata
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www.waikato.ac.nz



Principal Information sheet

Research: Exploring technology teachers' perceptions: A case study into the enactment of the New Zealand national curriculum.

Dear xxxx,

The purpose of this information letter is to seek permission to involve some teaching members of staff in a research project. I am the Co-ordinator of the Teacher Education Refresh Programme and an academic mentor for the Master in Teaching and Learning at Waikato University and the aim of this PhD action research is to generate understanding of the way that teachers' perceptions influence their interpretation of the technology education curriculum as well as their practice within the classroom. I am keen to observe how inquiry based professional development processes can encourage teachers' to become self-regulating and empowered in both their engagement with and enactment of technology education concepts. Your school is of key interest due to the establishment of the new technology department and because of your specialist staff's established reputation in the delivery of effective technology education.

It is expected that each teacher who agrees to participate in the research will be agreeing to a personal contribution of approximately fourteen hours of work over the full term of the project. I also seek permission to be on-site for approximately fifteen hours of observed department meeting time and two hours of lesson time per participant.

Consent for this research would involve the following:

- 1) Researcher attendance at regular technology education department meetings for the remainder of the academic year, beginning term 4, 2015 until the end of term one, 2016.
- 2) One lesson observation for each consenting teacher at the beginning and one at the end of the data generation period, as defined in point one.
- 3) Two semi-structured interviews, one at the beginning and one at the end of the data generation period, of approximately 40 minutes in duration and to commence at a time and place convenient to the relevant parties.
- 4) Regular teacher reflections about their evolving practice, through the use of online self-reporting methods and diary cam.
- 5) The sharing of teacher made resources throughout the data generation period, as appropriate.

This project has been approved by the University of Waikato, Faculty of Education Research Ethics Committee and will be conducted by myself, Elizabeth Reinsfield. The primary use of the data will be for my PhD thesis and may be used in seminars and/or conference presentations, publications and research reports.

Whilst every effort will be made to ensure confidentiality through the use of pseudonyms, this cannot be guaranteed. However, all information will be securely stored in a password protected electronic folder and only myself and my supervisors will have access to raw data. Care will be taken when reporting data publicly to ensure that the school and teacher names remain anonymous.

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The teachers of the technology department will not be coerced to partake in the research. If they wish to withdraw, they can do so at any time. If teachers do not communicate their wish to withdraw before the data is analysed in December 2015, it will be assumed that they have viewed and agreed to the use of their contributions in the research. Participants can withdraw by contacting the researcher by email or phone.

Once the research is completed, I will provide the school with access to the thesis on the Research Commons Database at <http://researchcommons.waikato.ac.nz/> which will provide information about the research, as well as any recommendations around future practice.

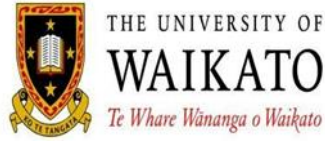
Should there be any concern or disputes throughout the research process, I should be contacted in the first instance on 078384433 or reinsl@waikato.ac.nz. If there are any further concerns, you can contact Dr. John Williams (Chief Supervisor) at 078384769 or pjwilliams@waikato.ac.nz or alternatively, Dr. Dianne Forbes (Second supervisor) at 078384466 or diforbes@waikato.ac.nz.

Liz Reinsfield

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PhD Research for Elizabeth Reinsfield: Permission to conduct research form: Principal

Research: Exploring technology teachers' perceptions: A case study into the enactment of the New Zealand national curriculum.

I have read the information provided about the PhD action research, as proposed by Elizabeth Reinsfield.

I understand that Liz will visit the school grounds regularly during from the beginning of Term 4, 2015, until the end of Term 1, 2016 and that consent for this research would involve the following:

- Researcher attendance at technology education department meetings for the time indicated above.
- One lesson observation for each consenting teacher at the beginning and one at the end of the data generation period, as defined in point one.
- Two semi-structured interviews, one at the beginning and one at the end of the data generation period which would not exceed 40 minutes in duration and would commence at a time and place convenient to the relevant parties.
- Regular teacher reflections about their evolving practice, through the use of online self-reporting methods.
- The sharing of teacher made resources throughout the data generation period, as appropriate.
- Access to the thesis on the Research Commons Database at <http://researchcommons.waikato.ac.nz/>, which will provide information about the research, as well as any recommendations around future practice.

I _____ (Please print) agree to the research methods proposed, as well as the receipt of a weblink to a final report, which will provide feedback about observed professional development processes as well as any recommendations for future practice.

Name of Principal: _____

Signature: _____ Date: _____

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Faculty of Education
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Head of Department information sheet

Research: Exploring technology teachers' perceptions: A case study into the enactment of the New Zealand national curriculum.

Dear xxxx,

The purpose of this information letter is to seek permission to involve your department members of staff in a research project. I am the Co-ordinator of the Teacher Education Refresh Programme and an academic mentor for the Masters in Teaching and Learning at Waikato University and the aim of this PhD action research is to generate understanding of the way that teachers' perceptions influence their interpretation of the technology education curriculum as well as their practice within the classroom. The purpose is to observe how inquiry based professional development processes can encourage teachers' to become self-regulating and empowered in both their engagement with and enactment of technology education concepts. Your department is of key interest due to your recent promotion to the leadership role within the technology department and because of your established reputation in the delivery of effective technology education.

It is expected that each teacher will be agreeing to a personal contribution of approximately fourteen hours of work over the full term of the research. In addition, I seek permission to attend department meetings for approximately fifteen hours plus two hours of lesson time per participant. This will not require any additional preparation for the teachers. The preferred number of technology teachers interested in being participants in this research would be between five and seven.

Consent for this research would involve the following:

- 1) Researcher attendance at regular technology education department meetings, beginning term 4, 2015 until the end of term 1, 2016.
- 2) One lesson observation for each consenting teacher at the beginning and one at the end of the data generation period, as defined in point one.
- 3) Two semi-structured interviews, one at the beginning and one at the end of the data generation period which would not exceed 40 minutes in duration and would commence at a time and place convenient to relevant parties.
- 4) Regular teacher reflections about their evolving practice, through the use of an online diary cam.
- 5) The sharing of teacher made resources throughout the data generation period, as appropriate.

This project has been approved by the University of Waikato, Faculty of Education Research Ethics Committee and is researched by myself, Elizabeth Reinsfield. The primary use of the data will be for my PhD thesis and may be used in seminars and/or conference presentations, publications and research reports.

Whilst every effort will be made to ensure confidentiality through the use of pseudonyms, this cannot be guaranteed. However, all information will be securely stored in a password protected electronic folder and only myself and my supervisors will have access to raw data. Care will be taken when reporting data publicly to ensure that the school and teacher names remain anonymous.

APPENDICES

The teachers of the technology department will not be coerced to partake in the research. If they wish to withdraw, they can do so at any time. If teachers do not communicate their wish to withdraw before the data is analysed in December 2015, it will be assumed that they have viewed and agreed to the use of their contributions in the research. Participants can withdraw by contacting the researcher by email or phone.

Once the research is completed, I will provide you with access to the thesis on the Research Commons Database at <http://researchcommons.waikato.ac.nz/>, which will provide information about the research, as well as any recommendations around future practice.

Should there be any concern or disputes throughout the research process, I should be contacted in the first instance on 078384433 or reinsl@waikato.ac.nz. If there are any further concerns, you can contact Dr. John Williams (Chief Supervisor) at 078384769 or pjwilliams@waikato.ac.nz or alternatively, Dr. Dianne Forbes (Second supervisor) at 078384466 or diforbes@waikato.ac.nz.

Liz Reinsfield

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PhD Research for Elizabeth Reinsfield: Permission to conduct research form: HOD

Exploring technology teachers' perceptions: A case study into the enactment of the New Zealand national curriculum.

I have read the information provided about the PhD action research, as proposed by Elizabeth Reinsfield.

I understand that Liz will visit the school grounds regularly from the beginning of Term 4 2015, until the end of Term 1, 2016 and that consent for this research would involve the following:

- Researcher attendance at regular technology education department meetings, beginning term 4, 2015 until the end of term 1, 2016.
- One lesson observation for each consenting teacher at the beginning and one at the end of the data generation period, as defined in point one.
- Two semi-structured interviews, one at the beginning and one at the end of the data generation period which would not exceed 40 minutes in duration and would commence at a time and place convenient to the relevant parties.
- Regular teacher reflections about their evolving practice, through the use of an online diary cam.
- The sharing of teacher made resources throughout the data generation period, as appropriate
- Access to the thesis on the Research Commons Database at <http://researchcommons.waikato.ac.nz/>, which will provide information about the research, as well as any recommendations around future practice.

I _____ (Please print) agree to the research methods proposed, as well as the receipt of a web link to a final report, which will provide feedback about observed professional development processes as well as any recommendations for future practice.

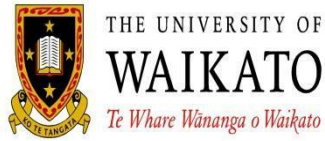
Name of Head of Department: _____

Signature: _____ Date: _____

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Teacher information sheet

Research: Exploring technology teachers' perceptions: A case study into the enactment of the New Zealand national curriculum.

The purpose of this information letter is to invite you to participate in a research project. I am the Co-ordinator of the Teacher Education Refresh Programme and an academic mentor for the Masters in Teaching and Learning at Waikato University and the aim of this PhD action research is to generate understanding of the way that teachers' perceptions influence their interpretation of the technology education curriculum as well as their practice within the classroom. The purpose is to observe how inquiry based professional development processes can encourage teachers' to become self-regulating and empowered in both their engagement with and enactment of technology education concepts. Your school is of key interest due to the recent change in educational leadership within the technology department and because of your established reputation in the delivery of effective technology education.

It is expected that you will be agreeing to a personal contribution of approximately fourteen hours of work over the full term of the research. In addition, I seek permission to observe you for approximately fifteen hours during department meetings as well as for approximately two hours of lesson time.

Your consent to participate in this research involves:

- 1) Two semi-structured interviews, one at the beginning and one at the end of the data generation period which would not exceed 40 minutes in duration and would commence at a time and place convenient to you.
- 2) Be video recorded during the technology education department meetings from term 4, 2015 until the end of term 1, 2016. The researcher will also be present at these meetings.
- 3) The sharing of teacher made resources throughout the data generation period, as appropriate.
- 4) Self-report on your teacher reflections after each curriculum meeting. It is anticipated that this would occur at least twice a term or when there are changes in your thinking about your evolving practice. This will be done through the use of an online diary cam in a manner, which is most convenient for you.
- 5) Have the researcher observe one lesson at the beginning and one lesson at the end of the data generation period. These observations would focus on your teaching approaches towards concepts within the Nature of Technology strand of the curriculum.

This project has been approved by the University of Waikato, Faculty of Education Research Ethics Committee. The primary use of the data collected will be for my PhD thesis and may be used in seminars and/or conference presentations, publications and research reports. I will provide you with the web reference to the report once it is completed.

APPENDICES

You will be sent all transcribed data via email and asked to check that it is a true representation of events. If I do not receive feedback from you, I will assume that you are satisfied that the content is accurate. All information will be securely stored in a password protected electronic folder in my University office. Whilst every effort will be made to ensure your confidentiality, this cannot be guaranteed. However, only myself and my supervisors will have access to raw data and care will be taken when reporting data publicly, through the use of pseudonyms, to ensure that you remain anonymous.

You should not feel coerced to partake in this research. If you wish to withdraw, you can do so at any time. If you do not communicate your wish to withdraw before the data is analysed in December 2015, it will be assumed that you have viewed and agreed to the use of your contributions in the research. You can withdraw by contacting me via email or phone.

Once the research is completed, I will provide you with access to the thesis on the Research Commons Database at <http://researchcommons.waikato.ac.nz/> which will provide information about the research, as well as any recommendations around future practice.

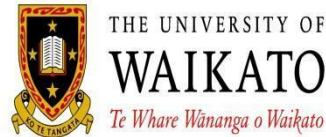
Should there be any concern or disputes throughout the research process, I should be contacted in the first instance on 078384433 or reinsl@waikato.ac.nz. If there are any further concerns, you can contact Dr. John Williams (Chief Supervisor) at 078384769 or pjwilliams@waikato.ac.nz or alternatively, Dr. Dianne Forbes (Second supervisor) at 078384466 or diforbes@waikato.ac.nz.

Liz Reinsfield

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PhD Research for Elizabeth Reinsfield: Teachers informed consent form

Research: Exploring technology teachers' perceptions: A case study into the enactment of the New Zealand national curriculum.

I have read the information provided about the PhD action research, as proposed by Elizabeth Reinsfield.

I understand that Liz is conducting her research during 2015, from the beginning of Term 4 until the end of Term 1, 2016 and that consent for this research would involve the following:

- Researcher attendance at regular technology education department meetings from term 4, 2015 until the end of term 1, 2016.
- One lesson observation for each consenting teacher at the beginning and one at the end of the data generation period, as defined in point one.
- Two semi-structured interviews, one at the beginning and one at the end of the data generation period which would not exceed 40 minutes in duration and would commence at a time and place convenient to the relevant parties.
- Regular teacher reflections about evolving practice, through the use of an online diary cam.
- The sharing of teacher made resources throughout the data generation period, as appropriate.
- Access to the thesis on the Research Commons Database at <http://researchcommons.waikato.ac.nz/>, which will provide information about the research, as well as any recommendations around future practice.

I agree to the research methods proposed, as well as the receipt of a web link to a final report, which will provide feedback about observed professional development processes as well as any recommendations for future practice.

Name of teacher participant: _____

Signature: _____ Date: _____

APPENDICES

Appendix E: Respondent validation meetings



Elizabeth Reinsfield <elizabeth.reinsfield@waikato.ac.nz>

12/2/16



Hi everyone,

I hope that it has been an enjoyable year for you all. I'm sure that you are all really looking forward to your summer break, so I thought that I would catch you before you left.

I'm currently in the data analysis stage of my PhD research, and am reviewing the lessons that I observed. For the purposes of representing your cases as accurately as possible, I'm wondering whether we could catch up early next year, to talk briefly about the lesson I observed, about what I'm seeing, and whether that was your intent?

I don't anticipate that this would take more than 30 minutes of your time, will send you the transcript prior to the meeting and show you a section of the lesson, to prompt your memory.

I would really appreciate you being able to give up this time and look forward to hearing from you. If you would prefer me to block out a morning or afternoon, where I come in and see each of you, one after the other, I'm happy to do that. Just name the date ;)

Cheers,

Liz

Liz Reinsfield 07 838 4466 Ext: 5008

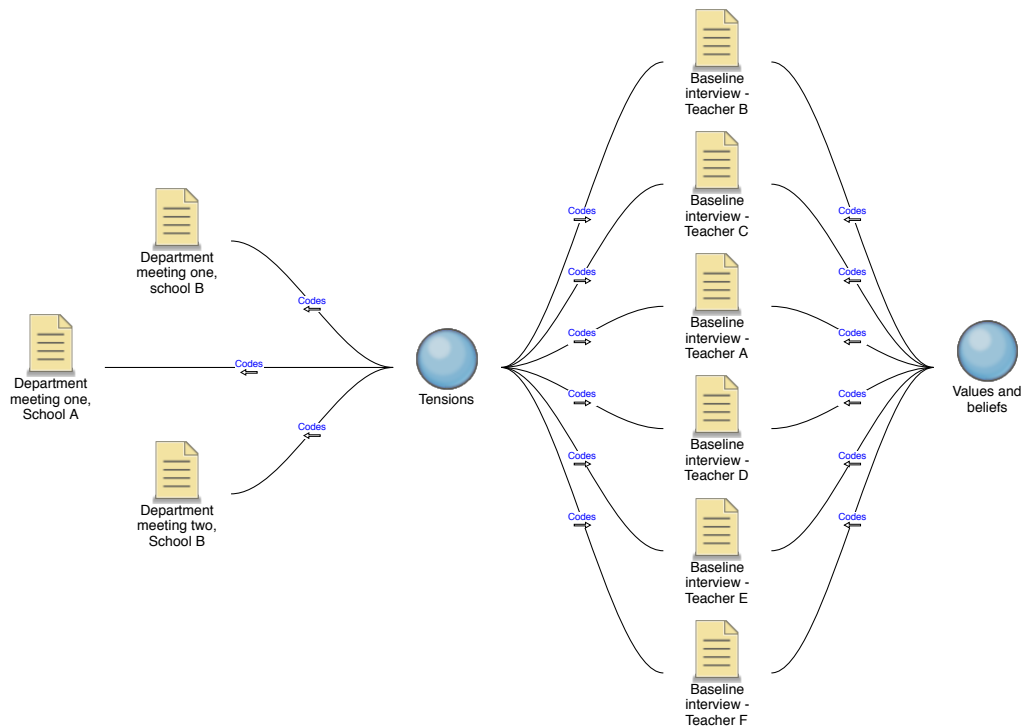
Skype: elizabeth.reinsfield

Co-ordinator Teacher Education Refresh Programme

Centre for Teacher Education

University of Waikato: Te Whare Wānanga o Waikato

Appendix F: Comparing the nodes in data sources



APPENDICES

Appendix G: Peer validation




	<p>consolidate it a bit more so they just do two perhaps, two different biscuits and then design your own, and done. And then perhaps another little unit in there, before we do these few little basic things that I've stuck in which is eggs and cheese, two little teaching moment things. Which also have meals connected to them. So when they finish the Biscuit Unit, they're just doing meals, because they ask for it so much. That's what they really want. And the parents want it. So they do chilli con carne, they do a pancake challenge where they've got to make a certain amount of mixture, and they see how high they can get, and they love it. And they get on to Facebook if they win. And then they do spaghetti bolognaise, a chocolate muffin, and things like that 'til the end of the year which – or the end of the term, which is not long now. They've just started, they did chilli yesterday, chilli con carne. So they've got the rest of the term to do these sort of things that are just random, but kind of connected to what the egg's doing in there, and what the cheese is doing there.</p>	<p>her ideas are based on products, rather than the concepts from the curriculum. Driving influences include students' and parental expectations around the development of life skills [making meals]. She acknowledges that there is time in the programme because the things at the end of the term are 'random' and so she is teaching about cheese. 9 eggs</p>
<p>Rules of practice [15]</p>	<p>I think it's become quite clear to me now, that because we don't do senior [Food] Technology here, I've got to bear in mind that there are certain skills that it's my responsibility to get through to the kids, before they start Hospitality. It would be a little bit difficult for them, just to do a certain number of units, knowing the Technology process beautifully, and coming up to starting a white sauce from scratch, because we never did a unit with white sauce in it, for example.</p>	<p>She is acknowledging her role in preparing students for the senior secondary school pathway.</p> <p>but focussed on product as the key to preparation.</p>
	<p>Interviewer: And do you have moderation meetings across the Department or anything like that with marking? Interviewee: No. Interviewer: No. Interviewee: Because no-one else is marking junior Food Tech, it is only me. But we, we have spoken about assessment, generally, for Technology, and we are definitely trying to get it more generic for report writing...</p>	<p>When asked about the moderation of technological concepts, she does not appear to appreciate the potential for across-department assessment, but acknowledges that they are doing this for report writing.</p>
<p>Social strategies [3]</p>	<p>One thing that I've really noticed lately, is that kids are coming in from intermediate having very high expectations. Now I know that there's some that don't have any expectations at all, but I always take on board what a kid will come up to you and say, sort of confidentially. And one boy came up to me the other day and he said, 'Miss, you know, I'm just – I hope you don't mind, but I'm just finding Food Tech so unchallenging.' And I said, 'Well okay, let's see why.' I said, 'Where did you go?' 'Cause it's really good to see which teachers are doing such a good job that you're actually unchallenging.</p>	<p>She talks here about her interaction with one student who indicated to her that he was not being challenged in her subject. She asked him about his past experiences in the subject. See Opinions *</p> <p>lack of understanding & awareness</p>


Helen's understanding of the technology curriculum appeared limited. She asserted that her practice was limited by the need to scaffold students towards Hospitality at Level one NCEA. Other factors that appeared to be impacting on her development of understanding appeared to be her strongly held values around student behaviour, safety issues, student and parental expectations and her ability to relinquish some of the projects she had developed within her programme. The limitations, moderators and enablers to her practice are outlined below

<p>Limitations</p>	<ol style="list-style-type: none"> 1. The noise in a practical room bothers the teacher 2. Students just want to/have the expectation that they should cook [*2] and see
---------------------------	--

APPENDICES

Appendix H: Copyright permission

HomeCreate AccountHelp



Title: Expansive Learning at Work:
Toward an activity theoretical
reconceptualization

Author: Yrjö Engeström

Publication: Journal of Education and Work

Publisher: Taylor & Francis

Date: Feb 1, 2001

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