Teachers' Perceptions of Technology and Technology Education, Years 7 to 10

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ABSTRACT

Technology has become an essential learning area in the New Zealand Curriculum. The concept of technology has undergone a change during three eras prior to the present. These eras are: (1) pre-1975 (Technical Education), (2) 1975 to 1995 (Technical/Technology Education), (3) 1995 until the present day (Technology Education) (Harwood, 2002). A key development in the concept of Technology accrued between 1995 and 2006 when the three strands of technology in New Zealand Curriculum 1995 (Technological Knowledge and Understanding, Technological Capability, and Technology and Society) were changed into the current three strands of Technological Practice, Technological Knowledge, and Nature of Technology. These shape the new concept of technology that exists today.

The aim of this study was to explore technology teachers' perceptions of technology and technology education. The study was undertaken in the period between 12 July 2008 and 24 December 2008, during the time that the new concept of technology in the New Zealand Draft Curriculum 2007 (Ministry of Education, 2007) was being introduced. While it was not compulsory for teachers to implement this new concept of technology, it was encouraged. I was interested to find out how teachers perceived this new concept.

The research initially addressed the questions:

1-What are the teachers' perceptions of technology education and the subject of technology that has recently been included in New Zealand Curriculum?

This led to four further questions:

2-How do teachers address the aims of technology in the New Zealand Curriculum in practice?

3-What are the influences of teaching technology on students' technological literacy?

4-What are the difficulties that teachers might face implementing technology in classrooms?

5-What would teachers suggest for improving teaching technology in schools?

The study involved a review of the literature and qualitative research in 3 schools (Year 7-10) in Auckland with four technology teachers. The data collection was from interviews with the four technology teachers. Semi-structured questions were used to obtain findings that helped me to understand the situation with technology in schools and provide decision-makers with ways to improve the teaching of technology in New Zealand. The findings of this study showed that technology was seen by technology teachers as a very important subject that improved their students' technological literacy, particularly if it was taught as a separate learning area.

This study also explored teachers' perceptions of the concepts of technology and of technology education according to New Zealand Curriculum (Ministry of Education, 2007a). Interviewed teachers had different perceptions of these concepts, variously shaped by their level of academic experience and professional development. Considering these differences led to an identification of some obstacles that face technology teachers today, namely: (1) insufficient funds; (2) a lack of mentoring for new teachers by senior teachers; (3) a lack of regular meetings for technology teachers; (4) a lack of professional development; (5) a lack of understanding of the nature of the new concept of technology; and (6) timetable issues.

I believe that this study will also help me to advise the Saudi Ministry of Education relative to integrating the concept of technology into its Curriculum (the Saudi Ministry invited me to help develop its curriculum, which was why I undertook this dissertation).

ATTESTATION OF AUTHORSHIP

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

Abbad Almutairi…….

Date:……

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Chapter I: Introduction

Technology in New Zealand Curriculum

Before beginning my discussion, I need to define the meanings of two terms frequently used in this study, namely: 'technology' and 'technology education'. Understanding the difference between them is important for the reader. For the purposes of this dissertation, 'technology' refers to the separate subject of technology as it is taught in New Zealand schools, while 'technology education' refers to the theoretical foundations that help technology teachers to teach technology. Technology education is "concerned with developing knowledge of technology and technological artefacts, and technological skills for students along with technological literacy" (Sade & Coll, 2003, p.89). In addition, Jones (cited in David & Richard, 2003, p.89) suggests that technology education usually focuses on technology as 'process' that is learning in which design and making things is important. Thus, technology education provides an opportunity for students to learn about the processes and knowledge related to technology as subject.

The subject of technology in the New Zealand Curriculum has undergone considerable change between 1990 and the present day, and different ideas on technology education have been discussed in order to establish a suitable framework for teaching technology in NZ schools.

In 1990 the National Party (a New Zealand centre-right political party) manifesto included the statement that education was one of its key policies and it established the "Achievement Initiative". At that time the National Party had not made a decision regarding whether Science and Technology were to be integrated or independent subjects (Turnbull, 2002); but in 1991 Dr. Lockwood Smith, the then Minister of Education, agreed (based on D. Ferguson's research) that technology should be a separate curriculum area rather than a branch of science (Turnbull, 2002). Currently, the difference between science and technology has been articulated as a difference in purpose. The overriding purpose of science is to explain "the natural world through iterative intellectual and

investigative practices that involve observations and controlled manipulations of that world ..... the purpose of technology is to intervene in the world to produce something "other" than that which currently exists" (Compton, 2004a, p.2).

From 1993 to 2007, the New Zealand Ministry of Education went through a process of reviewing curricula. The reasons behind the revision were identified by the Secretary for Education, Karen Sewell, in the foreword of the New Zealand Curriculum in 2007: "Our population has become increasingly diverse, technologies are more sophisticated, and the demands of the workplace are more complex. Our education system must respond to these and the other challenges of our times." (Ministry of Education, 2007a, p.4). Thus a review of the curriculum had been carried out in the years 2000–02, a reworked curriculum document was presented to teachers for consultation in 2006, and in 2007 the new curriculum was released.

The New Zealand Curriculum (2007a) identified eight learning areas: English, the arts, health and physical education, learning languages, mathematics and statistics, science, social sciences, and technology. With regard to these learning areas Compton and France (2006a) emphasised that: "Technology has had a growing presence as an essential learning area in the New Zealand national curriculum since the release of the draft technology curriculum in 1993." (p.1)

The 1995 New Zealand Curriculum (Ministry of Education, 1995) defined technology education as:

> A planned process designed to develop students' competence and confidence in understanding and using existing technologies and in creating solutions to technological problems. It contributes to the intellectual and practical development of students, as individuals and as informed members of a technological society. (p.7)

The 1995 curriculum had previously said that the aim of technology education in New Zealand "is to enable students to achieve technological literacy through the development

of Technological Knowledge and Understanding, Technological Capability, and Technology and Society." (p.8).

In February 1999, technology became a mandatory subject for all schools from years 1-10 (Jones, 2003). The 1995 curriculum identified the following 'strands' to weave into the teaching and learning of technology: (1) technological knowledge and understanding; (2) technological capability; and (3) understanding and awareness of the relationship between technology and society.

After 2000, the Ministry of Education decided to review these 1995 'strands' by applying some studies that aimed to clarify their limitations. Several research projects were conducted (Compton & Harwood, 2003; Compton & Harwood, 2005; Jones & Moreland, 2003; Moreland, Jones & Northover, 2001), and these led to a realisation that the technological practice strands on their own were not sufficient to develop students' technological literacy and "the nature of technological literacy being developed by students was somewhat limited" (Compton & Harwood, 2006, p.1). On its Techlink website (2008), the Ministry of Education revealed that further research identified how to remedy this gap and how to establish a clearer concept of technology. This had resulted in the revised Technology Section of the New Zealand Curriculum draft (Ministry of Education, 2006).

As a result of the general revision of all curriculum areas that occurred in 2006 and resulted in the New Zealand Curriculum Statement 2007 (Ministry of Education, 2007a), a new concept of technology education was introduced into New Zealand schools. While the goal of technology remained the same from 1995 to 2007, a new focus on 'the Nature of Technology' was added.

Three new strands were clearly identified: (1) Technological Practice, (2) Technological Knowledge, and (3) Nature of Technology. The New Zealand curriculum (Ministry of Education, 2007a) clarified that: "teaching and learning programmes will integrate all three, though a particular unit of work may focus on just one or two."(p.32). The literature review section will include an explanation of these strands.

The 2007 technology curriculum (Ministry of Education, 2007a) included a revised definition of the subject that commented on the importance and structure of technology in New Zealand schools. There, technology is defined as follows:

> Technology is intervention by design; the use of practical and intellectual resources to develop products and systems (technological outcomes) that expand human possibilities by addressing needs and realising opportunities. Adaptation and innovation are at the heart of technological practice. Quality outcomes result from thinking and practices that are informed, critical, and creative. (p.32)

From this definition, we see the importance and the aim of technology in New Zealand schools at present. This aim has been clearly explained and justified in the New Zealand Curriculum (2007a). It helps students to develop a broad technological literacy that will prepare them to positively contribute to developing their society as informed citizens. This aim will be achieved by teaching students practical skills that play major parts in the development of technological innovation, such as models, systems and products. Students also learn that technology is a part of human activity, that is it is " ... designed to meet needs and/or realise opportunities as they are perceived to be within specific time, space and place locations. Needs and opportunities can be described as focusing on the transformation, transportation, storage and/or control of materials, energy and information in some form" (Compton & France, 2006b, p.4).

Technology in New Zealand has been positioned within a sociocultural theoretical stance (Compton, 2001; Jones, 2001). The current concept of technology is viewed by some educators as: "having a clear focus on providing students with an understanding of technology as a situated human endeavour through providing them with opportunities to undertake their own technological practice and the practice of others in a highly reflective and critical manner" (Compton & Harwood, 2003).

Reading about technology in the New Zealand Curricula from 1995 to 2007 and in relevant articles (some of which I discuss further in Chapter II) leads me to conclude that the Ministry of Education in New Zealand has succeded in developing a sound theoretical framework for techology education in New Zealand schools. Technology as currently

presented in the state curriculum has the potential to create a technological generation to adequately meet the requirements of modern life in New Zealand and the world. However, for many reasons, theory does not always translate perfectly into practice. In the case of teachers for instance, a lack of professional development or teachers' reluctance to use new thories in teaching can mean a failure to change practice. Also, a lack of funding for the tools and materials needed to apply the proposed therories can limit their application. Therefore, I wanted to hear technology teachers' perceptions about the teaching of technology in the light of this theoretical framework. Understanding how technology teachers actually understand the current paradigm is the aim of this research.

Purpose of the Research

I believe that understanding technology teachers' perceptions of technology and technology education is important to help us to perceive the extent to which the current teaching of technology actually reflects the theoretical framework for the subject as given in the 2007 curriculum (Ministry of Education, 2007a). Teachers' experiences of implementing technology in New Zealand schools led me to consider possible gaps between the theory and practice of technology teaching in New Zealand schools.

I am an educator who has worked in the Ministry of Education in Saudi Arabia as a supervisor of Technology. As a researcher, my aims for this study were to explore New Zealand technology teachers' perceptions of technology and technology education as it was presented in the New Zealand Curriculum 2007. I also examined the differences between the 2007 curriculum and the New Zealand Curriculum 1995. While these two curricula share a common goal for technology, their conceptual frameworks are quite different.

I endeavoured to explore technology teacher's perceptions with regards to five factors: (1) the importance of introducing technology into schools as a separate subject area; (2) teachers' understanding of the new concept; (3) the influence of teaching technology on students' technological literacy; (4) the obstacles that face teachers in teaching technology; and (5) teachers' suggestions to improve the teaching of technology and the

possibility of applying their ideas in Saudi Arabia, where technology is not currently on the school curriculum.

Importance of the Research

The results of this study have helped me to become aware of challenges in the teaching of technology and to consider possible solutions. This study has shown the impact of teaching technology on students' technological literacy (outcomes) and the difficulties that some teachers face while teaching technology.

As stated above, the insights I gained through this research will be relevant to me in the future as an educator working the Ministry of Education in Saudi Arabia.

Conducting this study has assisted me in my thinking with respect to developing technology in the Saudi Arabian curriculum while taking into account the differing philosophies of both societies.

Research Focus

This study investigated the perceptions that a small sample of technology teachers held regarding teaching technology in New Zealand schools based on the new theoretical framework as described in the New Zealand Curriculum Statement 2007 (Ministry of Education, 2007a). I asked my sample of technology teachers:

> What were their perceptions of technology education and the subject of technology that has recently been included in New Zealand Curriculum?

Followed by such as:

- How do you address the aims of technology in New Zealand curriculum in practice?
- What are the influences of teaching technology on students' technological literacy?
- What are the difficulties that you face implementing technology in classrooms?

- What would you suggest for improving the teaching of technology in schools?

A Brief Description of Methodology

I used a qualitative approach that enabled me to explore the perceptions of four technology teachers who teach year 7 to 10 students. My aim in this study was to explore technology teachers' perceptions in depth, so I used a case study strategy. I used semi-structured interviews to collect data, analysed it and discussed my findings.

Chapter Overviews

This dissertation has several sections:

Chapter II is a review of the literature that underpinned my study. This chapter gives: (1) a background (concept and the structure) of technology in New Zealand; (2) a general view of how teachers perceive their work; and (3) details about the research of others concerning teachers' perceptions of technology and technology education in New Zealand.

In Chapter III, the methodology is presented. It includes three aspects: (1) research approach (qualitative approach); (2) applied strategy (case study); and (3) research methods (which involved sampling, data collection, data analysis and ethical considerations).

Findings are presented in Chapter IV. The common themes which emerged from the data are outlined with the support of substantial extracts from interview transcripts.

While Chapter IV outlined the findings, these are discussed in more detail in Chapter V. The discussion answers the research questions in the light of the literature and the interviews with teachers.

Chapter VI concludes this study with a consideration of the strengths and limitations of this research. The implications for enhancing technology teaching in schools are provided

and the possibility of implementing the subject in my country is briefly discussed. Finally, this chapter includes possible directions for future research on this topic.

Chapter II: Literature Review

From the early days of introducing technology in schools around the world, comparative research played a role in its development. Pavlova (n.d) revealed that "Technology education as a field of study was widely recognised by the end of the 1980s, although the debate on including Technology in school curricula started much earlier" (p.2). The literature I found shed light on technology education from different perspectives such as: the history of technology education, New Zealand's experience in technology education, and the attitudes of students, leaders and teachers of technology education. This first section is divided into three parts:

(1) A history of technology education in NZ, to provide the reader with the historical development of technology in NZ (from pre- 1975 until 1995)

(2) The development of technology education from 1995 until today, and

3) Technology teachers' perceptions of technology education in NZ

Technology in New Zealand Pre-1975 to 1995

The history of technical education in New Zealand has implications for technology education, because (among other reasons) many teachers who were earlier involved in technical subjects (such as woodworking and bookkeeping) later became involved (and may still be involved) in the delivery of technology education (Harwood & Compton, 2007). Thus, to better understand the problems around delivering technology education today, a study of the history of technical and early technological education is beneficial.

Harwood (2002) suggests that there have been three distinct eras in the development of technical/technology education in NZ: Technical Education Pre-1975; Technical/Technological Education between 1975 and 1995; and Technology Education from 1995 to the present.

Technology Education Pre-1975

Prior to 1975, the thrust of technology education was to "put children in touch with tangible realities to counter the 'bookishness' of the then existing curriculum" (McKenzie, 1992). Since free education was provided early in the twentieth century and had been extended to allow for many more secondary school students, provision had to be made for those less suited to academic (or "conventional") subjects. The subjects taught were later extended to typing, bookkeeping, agriculture and automotive engineering and more. However, those options were often resisted by parents as they were seen to be socially inferior because the subjects applied to manual labour. This led to financial assistance being provided for technical night schools and later to technical colleges, which subsequently became known as "polytechnic" colleges. These developed specialist, vocationally-focused programmes in response to employment market demands (McKenzie, Lee & Lee, 1990).

It was also part of the political agenda of the Liberal Government to use education to support a strong agricultural sector (Mawson, 1998, p.39). Thus technology was important for political and economic reasons, and not as result of social or educational pressures (McKenzie, 1992 et al, cited in Mawson, 1998, p.39).

The differences between technical and traditional colleges helped to reinforce inequalities of education between students aiming at "professions" (law, medicine) and the "trades" or manual work (plumbing, electricians, carpentry, automotive). This was assisted by "streaming" classes (from the 1950s) into essentially academic and technical groups, which helped maintain the status quo of existing social divisions between the white and blue collar workers (i.e. professional and working classes) (McKenzie 1992, cited in Mawson, 1998, p. 41). Such class distinctions continued in New Zealand education with tacit political support (Mawson, 1998).

The Thomas Report (1959) referred to by the Ministry of Education paper in 1959 (cited in Harwood, 2002, p.4) supported a "core curriculum" for all schools to the end of Year 10 which is the end of compulsory education. "School Certificate"—the national exams then established for Year 11—provided for examinations in those technical subjects.

Then in 1962, the Currie Commission findings resulted in the phasing out of the junior technical high schools. These often amalgamated with a style of schools known as "comprehensive" colleges (Harwood, 2002).

Unfortunately, technical education historically developed with a gender focus: manual education for boys and an introduction to the domestic and clerical (typing, bookkeeping) workforce for girls. Girls were not encouraged to participate in the technical/technological studies. This was seen by some as being a backlash to female emancipation (suffrage and temperance movements) (Mawson, 1998, p.40). The influential founder of the Plunket Society, Dr Sir Truby King, a Superintendent of Seacliff Mental Asylum in the early 1900s, endorsed that attitude, suggesting that mental stimulation had harmful effects on the physiological and psychological development of girls (Compton, 2001, p.14).

Gender and class divisions were scarcely challenged in New Zealand education until about 1970 and were perpetrated by streaming classes into essentially academic and technical groups, which helped maintain the status quo of existing social divisions between the white and blue collar workers (i.e. professional and working classes) (McKenzie, 1992).

The process of curriculum change during this period was largely controlled or initiated from Head Office (or Government) and new curricula were sent out to schools to be implemented. This slowly changed from the late 1970s due to a different social outlook by society at large, with social groups (parents, communities) wanting more direct involvement in their children's education (Mawson, 1998).

The style of education was product-focused as determined by the teachers, and used behaviourist theories of learning to help students attain appropriate competencies, (Compton & Harwood, 2004) i.e. step-by-step learning culminating in competence.

Thus, "student learning was totally predetermined and organised by the teacher prior to the learning experience." (Harwood, 2002, p 8). Understanding **what** was being done (that is, **how** or **why** it was being done) was less relevant in achieving the desired

outcome. As far back as 1941, the "rigid formalism" (Campbell, 1941, p.94, cited in Harwood, 2002, p.8) of such teaching styles was being criticised for stifling the natural creative abilities of young people, but teachers were not encouraged to depart from such behaviourist practices until 1975. Even then, the "home economics" classes generally delivered to girls remained behaviourist in practice while the content (knowledge and skills to be learnt) taught in classrooms focused on providing high quality "take home" products. Teaching focussed on a "lock-stepped" (rigid) construction of products in accordance with plans predetermined by the teacher (Harwood & Compton, 2002). This created a situation where teachers determined the finished product to be taught based on what they themselves had been taught, allowing for little to no student input.

Another difficulty in introducing technical instruction in some secondary schools was the expense of establishing specialist classrooms. Many schools were unwilling to foot the expense because of the perceived stigma associated with the community seeing the school as providing non-academic education (Watson, 1964; Compton; 2001). To overcome that, the Government provided additional funding for students, initially at night classes and later at technical day schools. Those schools later became the polytechnic institutions, but continued to be aimed at training students for the industrial workforce. Thus the continuation or replication of the existing educational/social strata was reinforced, perpetuating the continuance of a society differentiated by class and gender (McKenzie, Lee and Lee, 1990; Mawson, 1998; Compton 2001). Despite the Ministry's support to train technology teachers at that time, there was not the evident impact on classroom practice that one would anticipate (Mawson, 1998).

Technology Education Between 1975 and 1995

While the Currie Report (Department of Education 1962, cited in Harwood, 2002) began the process of change, it was a long time coming. (This report included some recommendations from the Department of Education in 1962 which aimed to move educational decision making from a centre-to-periphery model to a consultation and consensus model (McGee, 1997)).

Eventually, *The Workshop Craft Curriculum* was established in 1975 for classes up to Year 10, and a *Workshop Technology Curriculum* was provided in 1977 for Year 11 students. These documents introduced design and related studies to the classroom instruction.

Despite these new curricula, there was little significant change in actual teaching, because of the specialised layout of classrooms used for technical education, with both woodworking and domestic sciences based around the carpenter's bench and the oven (respectively). There was little physical space for students to sit in groups to design or plan their own projects.

Teachers themselves often provided another limitation to change. Some teachers (particularly older ones) could not embrace concepts of design usefulness and so on without professional development; these teachers continued to 'spoon-feed' students with instructions.

On a more positive note, gender differentiation was gradually diminished as girls were encouraged to participate in courses that had traditionally focused on the use of wood and metal, and boys were introduced to food and textile courses at 'manual training centres' and in intermediate schools (Mawson, 1998). In 1970 change came more slowly at the senior level, where technical subjects continued to be "highly gender specific" (Mawson, 1998, p. 42).

With the introduction of design as an integral element of technology education, students were encouraged to take an active role in deciding what their final product would look like and/or how it would function. By the 1990s, increased internal assessment rather

than the previous single examination system also encouraged development of design in both home economics and engineering/woodwork curricula. Teachers were less able to predetermine all the content, knowledge and skills that students needed to complete their projects. Less emphasis was placed on theory and more on practical application. This led in turn to a *problem-centred* approach (Print 1988, cited in Harwood, 2002, p.10) that fitted with constructivist rather than behaviourist practice. Here, learning is considered to be "an active process of mental construction and making sense" (Shepard 2000 p.6). A student's knowledge is understood to be formed by social interaction and validated by consensus. Constructivism encouraged learning outcomes to be identified early, so that students could develop understandings that were in keeping with established practices. With this paradigm shift, the "locus of control" over what was learnt shifted from the sole domain of the teacher to one shared between teacher and student (Stewart & Nolan, 1992).

Despite this, teachers continued to concentrate on the finished product rather than the process of construction and they still tended to define the products rather than allowing students to design their own. There was still emphasis on construction techniques rather than on allowing students to reach better understandings by actively thinking things through. Therefore, the behaviourist approach continued.

Mawson (1998) suggests that the subsequent changes in the new technology curriculum 1995 had their origin in the New Right economic policies. That is there was a stronger emphasis on education from an economic perspective, and this perspective tended to ignore questions about the nature and structure of knowledge (Peters & Marshall, 1996).

The Key Developments in Technology Education from 1995 Until Today

The New Zealand Curriculum Framework (Ministry of Education, 1993a) provided an overarching framework for the development of curricula in New Zealand and defined seven broad essential learning areas rather than subject areas (Jones, 2003). Technology was included as one of these seven learning areas.

The 1993 Framework was followed by the first draft of a technology curriculum (Harwood and Compton, 2007). This draft was developed and released to schools, aiming for feedback from educators at the end of 1993 (Ministry of Education 1993b). The final edition, *Technology in the New Zealand Curriculum* (Ministry of Education, 1995) "was officially launched in late 1995, and gazetted in February 1999 as mandatory for all schools from years 1-10" (Harwood, 2002, p.12). The delay in implementing such curriculum changes was probably due to the Ministry of Education's desire to give schools this to make the necessary changes.

Technology in the New Zealand Curriculum (1995) stated that the aim of technology education in New Zealand was to expand students' technological literacy. This aim was linked to three "interrelated learning strands" (Compton & Harwood, 2005, p.256): "The aim of technology education is to enable students to achieve technological literacy through the development of Technological Knowledge and Understanding, Technological Capability and Technology and Society" (Ministry of Education, 1995). These three strands "needed to be brought together in all technology programmes to ensure students were provided with opportunities to undertake technological practice" (Techlink 2008).

However, after more than ten years of implementing the 1995 curriculum in schools from years 1-13, Techlink (2008) reported how the Ministry of Education had needed to introduce technology practice as it was not clear in this 1995 curriculum, they said:

> It has been noted that the nature of the technological literacy resulting from students undertaking technological practice alone was often limited in breadth and depth. It was also often lacking the level of critical analysis required for more informed decision-making in students' own practice and, in particular, making choices of a more general nature with regards to technology per se. (n.p)

Therefore it was decided to review the 1995 strands by considering some studies that aimed to clarify their limitations. According to Techlink (2008), this research led to a realisation that technological practice strands on their own were not sufficient for developing students' technological literacy, and further research was indicated to

identify what might be absent and to remedy those gaps, resulting in the revised *Technology Curriculum in the New Zealand Curriculum* (Ministry of Education, 2006).

Compton and Harwood (2006) revealed that at this time, "a strong sociological focus was argued as key to supporting student technological practice, in order to move technological literacy away from a 'functional' orientation to a literacy that was 'Liberatory' in nature" (p.1). Moreover, Compton and France (2006a) explained that:

> The review showed that relying on technological practice alone often resulted in a shallow and narrow technological literacy that was unable to support a level of informed critically [sic] the 1995 curriculum had aimed for. To redress this, it was argued in 2004, that there needed to be a stronger focus on the philosophical basis of technology and identified generic technological knowledge. (p.2)

Based on these factors, the development team for technology decided to improve the aim and amend the concept of technology education as part of the New Zealand Curriculum Marautanga Project. The overall aim of technology was not changed: it remained focused on developing students' technological literacy, but the change was in the concept of technological literacy underpinning this aim (Compton & Harwood, 2006). This new concept of technological literacy had evolved from the 1995 technology curriculum to enable students to develop a literacy that was deeper, broader and more critical in nature. This evolution was explained by Compton & France (2006b) in the way that the three 1995 strands were modified in Curriculum into the following strands:

1-Technological practice

2- Technological knowledge

3- Nature of technology

The Structure of the Learning Area in New Zealand

The New Zealand Curriculum (Ministry of Education, 2007a) clearly stated that the learning area of technology "comprises three strands: *Technological Practice, Technological Knowledge*, and *Nature of Technology*. Teaching and learning programmes will integrate all three, though a particular unit of work may focus on just one or two."

Knowledge and skills were to be learnt in context. By offering a variety of contexts, teachers would help their students to recognise links and develop generic understandings. Students should be encouraged to access relevant knowledge and skills from other learning areas.

1- Technological Practice

According to the Ministry of Education (1995), in the Technological Practice strand, students examine the practice of others and undertake their own. They 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. They also learn to consider ethics, legal requirements, protocols, codes of practice, and the needs of and potential impacts on stakeholders and the environment. Compton and Harwood (2003) explained that technological practice is a developing concept within technology education in New Zealand. It is currently defined as an overall descriptor for the thoughts, actions and interactions that occur as part of any technological endeavour (Compton & Harwood 1999a; Compton 2001; Ministry of Education 2001, cited in Compton, 2003, p. 3). There are six factors of technological practice which should be considered within any context and are listed by Compton & Harwood (2003):

- the perspectives of the people involved in the development;
- the capability of the people involved in the development;
- the range of technological knowledge, skills and resources available at any time;

- knowledge and skills from other domains as appropriate;
- the society and environment that impact upon the development;
- the society and environment that the development will impact upon. (p.4)

Moreover, the importance of developing knowledge about how to organise and manage the development within a societal context was emphasised by Gawith (1999) when he defined technology practice as "the process of improving existing products, or developing new products while at the same time managing the tension between the constraints of society and technological development"(p.2). Gawith also clearly linked technology practice with a problem-solving approach. He believed that technology practice included six general aspects about the way technologists approach and carry out their practice. These aspects were:

- A series of problem-solving type activities
- A purposeful process that is focused on achieving a solution
- A systematic, rational approach that endeavours wherever possible to quantify and record in order to ensure repeatability, reflection and quality assurance
- A process of constant decision and compromise on the part of technologists
- A disciplined application of innovation, flair and creativity
- An ability to consider self-practice and alter and improve the processes, techniques and methodologies used (p.2)

Finally, Gawith asserted that these aspects of technology practice can be effectively implanted if teachers recognise the elements of technology practice that specifically help students to learn the basic principles and techniques of technology and how to apply them to work and society. Additionally, students must learn how to be organised, and how to extend their ideas and technical skills. This involves developing an understanding of society's needs and learning research skills (both scholarly research and market research).

Components of Technological Practice

In reporting findings of over two years (1999 & 2000) of classroom research, *Technology Education Assessment in Lower Secondary* pointed out that there are three components of technological practice that have occurred as a result of technological practice activities undertaken by students. These components are: *brief development, planning for practice, and outcome development and evaluation* (Harwood & Compton, 2007).

Teaching *brief development* provides students with more opportunity to discover the values of other cultures, as the identification of a real need that is based on a comprehensive examination and critical analysis of context, related issues, and a wide range of consumers' values and needs (Compton, 2006). This component also asks: What is to be done? Why should it be done? These questions, in my opinion, present the importance of understanding the role of *tacit knowledge* in technology education that "is embedded in the subconscious" (Compton, 2004b, p.3).

The *planning for practice* component presents the importance of taking care of the environment and helps students to develop ethical decisions and to deal with appropriate resources around sustainable development. The ongoing reflection and evaluation of past practice factors are seen by Compton (2006) as critical to this component, in that it helps students to explore their own and others' values, and to develop an understanding of how these values influence the process of decision-making.

The final component in technological practice, *outcome development and evaluation,* was explained by the Minstry of Education (2007b) as "the development of a technological outcome (product or system), or any other outcome of technological practice concepts, plans, models, etc.", and it involves the creative generation of design ideas and the refinement of potential outcomes. This is achieved through ongoing research, experimentation, analysis, testing and evaluation against the specifications of the brief. Developments should be based on the evaluation of the functional modelling undertaken during practice, and prior to the realisation of the outcome. Refinement of a realised

technological outcome should be informed by evaluations from prototype testing *in situ*, in order to optimise its fitness for purpose. Outcome Development and Evaluation can be thought of as the trialling and production practices of technological practice" (p.2).

2- Technological Knowledge

Through the Technological Knowledge strand, students develop knowledge particular to technological enterprises and environments and understandings of how and why things work. Students learn how functional modelling is used to evaluate design ideas and how prototyping is used to evaluate the fitness-for-purpose of systems and products as they are developed. An understanding of material properties, uses and development is essential to understanding how and why products work the way they do. Similarly, an understanding of the essential parts of systems and how these work together is necessary to understanding how and why systems operate in the way they do (Ministry of Education, 2007a).

Components of Technological Knowledge

This strand includes three components: *Technological modelling, technological products* and *technological systems*.

Technological modelling involves learning how to create functional models and prototypes for products before evaluating and further developing them. (Ministry of Education, 2007b). Evaluation is a valuable learning process whereby students can develop understanding about usefulness, market needs and production processes:

> Functional modelling allows for the ongoing evaluation of design concepts for yet-to-be-realised technological outcomes. Prototyping allows for the evaluation of the fitness for purpose of the technological outcome itself. Through technological modelling, evidence is gathered to justify decision-making within technological practice. This modelling is crucial for the exploration of influences on the development, and for the informed prediction of the possible and probable consequences of the proposed outcome. Technological modelling is underpinned by functional and practical reasoning. (p. 50)

The *technological products* component relates to materials and their usefulness for product development. Students should develop their ability to evaluate materials in terms of their best usefulness (Ministry of Education, 2007b). Understandings developed will include:

> Understandings of new materials formulation and their potential impacts on future product function. The impact of material use and development on product life cycles/expectancy is also included with regards to understanding material sustainability in its broadest sense. (p.58)

The last component, "*technological systems"*, was explained by Compton and France (2006a) as an understanding of how product components work together:

> Technological systems consist of interconnected components designed to work together to control the transformation of materials, energy and information. Understanding how the components work together is as important as understanding the nature of the individual components. (p.10)

Students will develop their ability to understand technological language and key concepts like input, output, transformation and control (Compton & France, 2006b, p. 10). Students need to develop the ability to critically evaluate possible areas of redundancy or ongoing reliability in a technological system's design. We also need to help students to understand the hidden processes and workings of everyday products (*ibid*)

3- Nature of Technology

The Nature of Technology is a theoretical strand that aims to help students to distinguish the subject of technology from other disciplines. Students learn how our lives have been affected by technology, particularly as it has evolved and they explore how such developments have historically affected various groups in society. (Ministry of Education, 2007a). Such investigation leads to valuable critical thinking:

> As they do so, they come to appreciate the socially-embedded nature of technology and become increasingly able to engage with current and historical issues and to explore future scenarios. (p. 32)

As students reach the senior secondary level, they are helped by this strand to integrate technology with learning from other subject areas:

> For example, students working with materials and/or food technology will need to refer to chemistry, and students working on an architectural project will find that an understanding of art history is invaluable. (*ibid*)

The Components of the Nature of Technology

There are two components of nature of technology identified by Compton and France (2006a): *Characteristics of technology* and *technological outcomes*. They explained the first component as "a purposeful intervention by design: human activity that can result in technological outcomes that impact the world" (p.6). Technology opens the horizon for certain activities that form particular outcomes (those that convert, store, transfer and manage materials, energy and information) (Compton & France, 2006a). I believe that through this component, students should understand the historical development of technology because it will help them to observe the development of our ability as human beings to invent what we want to facilitate in our lives.

The second component, *technological outcome*s, is defined as the material products developed for a particular purpose "through technological practice." (Compton & France, 2006a, p.6). Technological outcomes have two interconnected elements that are *physical* and *functional nature***,** leaving them to be described when embedded in their socio-cultural and chronological contexts (Compton & France, 2006b). A technological outcome is evaluated in terms of its fitness for purpose through two stages. The first is the proper function that is applied to explain the designer's intended function. The second stage is an 'alternative' function which is developed by clients in ways not planned by the designer (Compton & France, 2006b).

New Zealand Technology Teachers' Perceptions of Technology and Technology Education Prior to the 2007 New Zealand Curriculum

Some research has been conducted in New Zealand to determine the impact of teaching technology on students from the technology teachers' perceptions. A summary of this earlier work produces a background to the present study.

Jones and Compton (1998) conducted research in 14 classrooms with 14 technology teachers. In this research, the process of working with teachers took into account teachers' perceptions of technology; technology education; existing ideas of teaching and learning; needs and expectations; and classroom experiences in technology.

Findings from this study revealed that the introduction of the 'new' learning area in schools—technology—was problematic. Teachers' existing sub-cultures in terms of teaching and learning, specialized subject area, and the school itself, in association with their concepts of technology, influenced the development of the classroom environments and strategies. Subsequent student activities, classroom observation and teacher interviews suggested that technological knowledge, an understanding of technological practice, and an appropriate conceptualisation of technology and technology education were important in teaching within the learning area of technology education. However, this study suggested that, in order to introduce technology into the classroom, it is important not only to have a developed concept of technology but also to have an awareness and understanding of technological activity. Further, teachers will need to experience technological practice and techniques in some form to become confident in the teaching of technology.

Moreover, the above study reported on the final stage of the three year Learning Technology Education (LITE) research project funded by the New Zealand Ministry of Education (Jones and Carr, 1992). This study investigated teachers' perceptions of technology as part of the Learning in Technology Education Project, based at the Centre for Science and Mathematics Education Research at the University of Waikato.

In this project, 30 teachers (16 primary and 14 secondary) were interviewed to examine their perceptions of existing technology education. Many teachers used their past

experiences in and out of school to construct a perception of technology education. Comparing findings of this study with the previous study indicates that, since technology was a new learning area, teachers' knowledge of their own conceptualisation of technology as a separate subject was unclear and limited (Jones & Carr, 1992). In contrast, after five years in teaching technology, teachers' awareness of the concept of technology as a learning area was evident and clearly influenced by the cultural dimension in schools. Jones and Compton (1998) identified that before 1995, teachers did not have the ability to view and to reflect on their practice from their notion of technology. Therefore, they concluded that "their concept of technology would be problematic due to the non-consensual nature of technology education presently held by teachers" (p.53).

Similarly, Paechter (1991, cited in Harwood, 2002) identified teachers as having a personal view of the practice of teaching within their concept of subject learning: this has been referred to as a subject sub-culture, and lead to a consensual view about the nature of the subject, the way it should be taught, the role of the teacher, and what might be expected of the student (cited in Compton and Jones, 1998). Also, I would argue that this problem is attributable to the absence of a theoretical underpinning for Technology in the New Zealand curriculum prior to 1993. In other words, there was no theory behind how and why technology was taught prior to 1993.

I believe that establishing a clear theoretical framework for technology in New Zealand (Ministry of Education, 1995) has played a role in promoting teachers' understanding of technology in schools. Technology teachers should teach technology based on a theoretical foundation rather than merely teaching skills. In today's world, students need to learn how to design for the public's need, rather than how to follow orders perfectly and to satisfy teachers.

Gass (2007) identified two types of technology teachers: qualified technology teachers and teachers who have been transformed from typing to IT, carpentry to construction, and metal work to hard materials. This second group often focus on method rather than theory and so they need professional development to help them fit their experience to the needs

of today's technological processes. This is a key issue to address in order to improve technology teaching. Gass went on to say that principle must underlie practice and link to work as whole "like a pair of scissors cutting the edge." (p.8)

Two different teachers' development programmes have been developed and used in the New Zealand context: Facilitator Training, and the Technology Teacher Development Resource Package. These programmes were examined by Compton and Jones (1998) to evaluate their outcomes. They commented that the participants considered that it was important to develop a theoretical background in the area of technology education: "Some of their comments highlighted the fact that they did not think the theoretical aspects were particularly relevant initially, but they appreciated their importance later, when undertaking professional development activities of their own." (p.158). This study also supported the idea that a professional development program helps technology teachers to develop their understanding of the concept of technology. Sixty-three per cent found the programme assisted them with their understanding of the concept of technology.

The researchers suggested that six key features should be taken into account when developing technology education teacher professional development programmes consistent with the New Zealand national curriculum statement in technology. These key features stressed the importance of developing: a strong concept of technology and technology education; an understanding of technological practice in a range of contexts; technological knowledge in different areas; technological skills in different areas; an understanding of how people's prior experience shapes their understanding of the concept of technology education; and an understanding of the way in which technology education can occur as an essential learning area. Gass (2007) argued that while developing the concept of technology, the position of technology education should clearly answer the following questions: is the technology curriculum asking us to teach principles and not practice? Process and not product? Knowledge and not skill? Design and not action? Planning and not doing?

In my opinion, the New Zealand Curriculum 2007 does help students to understand the principles before the practice. They can learn how to make a plan for any product, and design products based on appropriate processes. This reflects that the new concept of technology does not separate knowledge from skills but encourages teachers and students to practice skills based on a systemic knowledge.

Jones and Moreland (1998) report that there have been developments in teachers' perceptions of technology and technology education since 1993. Teachers now have much broader concepts of technology and technology education, and act in accordance with the technology curriculum. However, greater teacher understanding is required of technological concepts and procedures in the different technological areas.

In 2004, Jones, Harlow & Cowie investigated teachers' experiences of the implementation of the technology curriculum in New Zealand schools from years 1–13. These academics sought to explore how effective the curriculum is in practice. They also discussed how their findings can inform future developments.

A sample of ten percent of all types of New Zealand schools (both state and private) was required for the Jones, Harlow & Cowie study. Teachers were asked many questions to find out how useful they had found the technology curriculum statement. Questions covered areas such as the structure of the curriculum, the support and professional development for technology teachers, assessment and reporting issues, and strategies for curriculum implementation. Overall, the results provided a broad sweep of information about teachers' experiences, and the general impression was that most teachers were reasonably positive about teaching based on the curriculum statement.

Jones, Harlow & Cowie found that over 40% of primary teachers declared that the curriculum statement was always or sometimes helpful in planning their classroom activities, while 27% of secondary teachers said they found it helpful. Worryingly, the remaining percentage said they did not find the statement helpful.

In addition, the researchers revealed that primary teachers use the technology curriculum statement for guidance on curriculum levels more than secondary teachers. I think this

situation points to the fact that there is a real need for professional development for secondary technology teachers. Also we need to explore why the curriculum statement is less useful to secondary teachers. Jones, Harlow & Cowie found that 50% of teachers for years 9-13 wanted to make changes to the structure of the technology curriculum statement. They partly identified what these could be, finding that the most popular changes would be 'making it simpler to understand' and 'including better developed learning and assessment examples'.

Jones, Harlow & Cowie found most teachers (64%), whether primary or secondary, considered that technology should be compulsory for all students to the end of Year 10: they believed that it provides students with important life skills like communication and problem-solving skills.

Moreover, the study identified four major challenges for technology teachers. The lack of equipment needed to implement the technology was seen by 50% of all teachers they surveyed as the main obstacle in teaching technology. Adding another burden on teachers as a result of introducing technology to schools was the second major challenge for 32% of all teachers (in particular the primary teachers), who complained about the 'crowded curriculum'. A lack of professional development in technology education was emphasised by 22% teachers as a major challenge. Finally, understanding the curriculum was the fourth major challenge identified by teachers (22%). I would observe that this percentage is nearly identical with the percentage lacking professional development.

Aside from their findings on the current curriculum document, the Jones, Harlow & Cowie study also looked at why specialist technology teachers of years 7-8 found difficulties in teaching technology based on the 1995 document. The authors noted that technology teachers had experience in cooking, sewing and/or woodwork/metalwork but have been expected to adapt to a single blended technological concept. These teachers said that they found it difficult to integrate the traditional skills that were an important element of how they used to teach prior to the technology curriculum. This is, in my view, attributable to an absence of a theoretical foundation for technology

As I mentioned above, a theoretical foundation is important in helping teachers to fit their experiences into teaching technology based on the current framework. Such a theoretical framework will, in my opinion, organize teachers' ideas and guide them to fit their practical knowledge into an appropriate relationship with the process of teaching technology. For instance, teachers' experiences might easily connect to the different aspects of teaching technology education that were introduced in the 2007 curriculum, (such as technological knowledge, nature of technology and technological practices).

In summary, it can be seen that the concept of Technology has changed markedly between 1995 and 2007. However, the literature suggests that many teachers have not come to understand the key components of this change. They continue to use behavourist approaches in their pedagogy. I would argue that it is important that teachers receive support to develop a more constructivist approach. Therefore, in my research I explored how teachers perceive technology in the New Zealand Curriculum 2007 and I tried to identify the possible gaps in their understanding.

Chapter III: Research Design

This study was designed to explore New Zealand technology teachers' perceptions of technology and technology education. This chapter covers my research approach, strategy and methods, and discusses data collection, data analysis and ethical considerations.

Research Approach

The main research question and the four secondary questions are as follows:

(a) What are the teachers' perceptions of technology education and the subject of technology that has recently been included in the New Zealand Curriculum?

(b) How do the teachers address the aims of technology in New Zealand curriculum in practice?

(c) What are the influences of teaching technology on students' technological literacy?

(d) What are the difficulties that teachers might face implementing technology in classrooms?

(e) What would teachers suggest for improving teaching technology in schools?

These questions were answered using a qualitative approach in which I interacted with interviewees to find their perceptions of technology in New Zealand schools. A qualitative approach is considered by many researchers as the appropriate way to obtain in-depth knowledge and insight concerning human experience (Amenkhienan & Kogan, 2004).

Strategy

The research used a case studies strategy. A case study typically focuses on a single case or multiple, comparable cases. Yin (1983; 1989; and 1994) explains that a case study comprises direct or indirect detailed observations and other sources of qualitative

approach to explore a complex social situation. Case studies have become one of the most popular means to apply qualitative research (Stake, 1994). According to Merriam, (1988) Yin (1989) Stake (1994) a case study is "a detailed examination of one setting, or a single subject, a single depository of documents, or one particular event".

According to Stake (1994), the purpose of using a case study is not to construct a theory about a particular phenomenon, but to conduct an in-depth investigation. Drawing on Stake's ideas, I used interviews in my four cases studies to explore these technology teachers' perceptions of technology and technology education in depth.

Research Methods

Sampling: Because I wanted to study teachers' perceptions of technology and technology education, I chose participants who had been directly involved in teaching technology. I chose "convenience sampling" which was defined by Walliman (2005) as involving "what is immediately available"(p.278). To put it simply, convenience sampling helped me to choose the participants who were easiest to reach: my aim was to describe a case rather than generalise. This research involved four teachers of technology whose students are in Years 7 to 10. They were chosen from three schools in West Auckland. The reason I chose this number of schools and teachers for my research was due to the short period I had for conducting it, and also to the fact that this study is a "small dissertation". I believe this sample was too small for me to make any generalisations, but I think it can give some small indications of the views of technology teachers (of years 7-10 students; children age 12-15) in New Zealand.

Method of selecting participants: Once I received the necessary ethics approval from the Auckland University of Technology, I went to schools to select participants. Firstly, I talked with the teachers about my project. I then arranged to interview the teachers selected. At the same time, the information sheets (Appendix A) of my research were distributed. Later, we decided on an appropriate time and place for the interviews.

Delimitation of the Research

Identifying the research boundary is a very important part of social research. It informs the reader about subject, time and the place of the research. This research was bounded as follows:

Research subject: this research investigates the perceptions of four teachers of Years 7-10 concerning technology and technology education.

Research period: this project was conducted between 21 July 2008 and 24 December 2008. The data was collected between September 15 and 24, 2008 and analysed from September 25 until October 25, 2008.

Research place: three schools (Years 7-10) in West Auckland.

Data Collection

The basic tool of this research was the interview. "The interview is one of the main data collection tools in qualitative research" (Punch, 2005. p.168). Creswell (2003) identified that a key advantage of this type of data collection is the way that participants can provide historical information. Also, researchers have "control" over the line of questioning. Similarly, Punch (2005) believes that the interview is one of the most powerful ways we have of understanding others. Fontana and Frey (1994) use a three-way classification of structured, semi-structured and unstructured interviews. In my research, I used semi-structured interviews (face-to-face) for the reasons identified by Dawson (2002): "in this type of interview, the researcher wants to know specific information which can be compared and contrasted with information gained in other interviews."(p. 29). However, Creswell (2003) criticised this type of interview by pointing out some of its limitations. For example, he stated that people will understand the interviewers question in different ways. Also, this type of interview occurs in a selected "place" rather than in the interviewee's natural setting. Finally, the researcher's presence in this type of interviews may bias responses.

I asked participants the same questions to explore the various ideas regarding the participants' perceptions of technology and then I analyzed their responses to answer research questions. However, I allowed them to raise other important information about technology education. The interviews took place at the participants' schools.

Data Analysis

I analysed data thoroughly in two stages as follows:

1. Preparing data: I transcribed all the interviews with the assistance of a professional transcriber before returning the transcripts to teachers for feedback.
2. Analysing data: I read the transcripts and identified themes (using coding), before summarising and discussing these themes.

Ethical Considerations

Ethical approval was obtained from the Auckland University of Technology Ethics Committee. This approval asserted that all participants must be referred to by pseudonyms.

This study took into account the ethical issues emphasised in the Postgraduate handbook (AUT, 2008).

- **Informed and Voluntary consent**

  I provided participants with information (Consent form, Appendix B) in clear and simple language. Participants were informed as follows:

  1) The researcher's name
  2) The procedures that would be used (in this research, an interview was used)
  3) The aim of this research and how the information would be used: for example, whether this research would be published or not
  4) Participants could withdraw from the process without penalty before the data collection process was completed

5) What would happen to the information, and whether it would be aggregated with other information or not
6) It was explained that the information would be transcribed by another person and this person would be required to sign a confidentiality form.
7) What would happen to the data after completing the research
8) The possibility of seeing the final report and if so, how this process would be conducted

- **Respect for rights of privacy and confidentiality**

  Privacy and confidentiality must be respected. Therefore, I considered and protected the identity of participants and their schools at all stages of the research. For example, I did not disclose the name of any participant when interviewing another, and I was responsible for keeping information (including the identity of participants) confidential and secure from interception or appropriation by unauthorised persons, or for any other purposes than the approved research.

- **Minimisation of risk**

  I did not expose participants to unacceptable levels of risk or harm, socially, physically or psychologically (including stress, emotional distress, fatigue, embarrassment and cultural dissonance). I believe that minor risks such as discomfort cannot be completely eliminated but I was able to minimise any risk involved in this research.

- **Social and cultural sensitivity, including commitment to the principles of the Treaty of Waitangi/Te Tiriti O Waitangi**

  I did not specifically target Maori teachers, but I respected the social and cultural sensitivity of all participants through: 1) Respecting cultural differences and ways of knowing; 2) Regard for participants' physical, mental, spiritual, and social well-being.

In my application for ethical approval I addressed the issues of the Treaty of Waitangi.

- **Research adequacy**

  I aimed to conduct research through applying appropriate standards of adequacy that included: 1) clearly identifying the projects' goals; 2) designing the research to achieve these goals; 3) intending that the research will contribute to the advancement of technology education.

Chapter IV: Findings

In this chapter I draw from the interview data. I first introduce the participants before discussing the common themes produced from the interviews. Quotations from the interviews' transcripts are presented to support these themes.

I have used two codes: pseudonyms with letters, and numbers. These codes enable me to maintain the privacy of participants and their schools (see table 1):

Teachers	Schools
A (Matthew)	1
B(Stephen)	2
C & D (Angela/ John)	3

Table 1: Coding

Participants' Backgrounds

Participant A: Matthew

Matthew has been working as a technology teacher for years 7 to 13 students at school (1). He has been teaching for 10 years. During the first year of his teaching experience he taught English and Economics in a high school in Auckland. He then moved to his current school (1) because he felt that teaching English and Economics did not suit his personal philosophy. His school invited him to set up the Technology course and in particular the computer section. In terms of his qualifications, Matthew is well qualified to teach technology and is currently a postgraduate student. Besides teaching he is interested in a range of writing and business activities.

Participant B: Stephen

Stephen has a diploma in civil engineering and previously worked for three years in a teaching institution. This college accepted his engineering experience as professional development for Technology. He has been teaching Technology for eight years at School (2). He teaches "hard materials" and "electronics" for Year 7 and 8 students as two major

foci of Technology in his school. He is happy with his job as a technology teacher because he believes that the subject is important.

Participant C: Angela

The third participant is Angela who has two qualifications in education: a Bachelor of Education and a Diploma in Education. She had taught years 1, 2, 5 and 6 for 12 years, but ten weeks before the interview she moved to school (3) teaching food technology to Year 7 and 8 students. She enjoys her work and described teaching technology as specialised, coming from teaching different subjects to just the one subject which is Technology.

Participant D: John

Also in school (3), I interviewed John who had long experience in teaching technology (33 years) before technology became a separate subject. He spent his first three years at an Auckland intermediate school then moved to school (3) where he is still teaching technology. He has a diploma in teaching and an advanced trade certificate. He is interested in teaching hard materials, enjoys teaching this age group, and he likes the challenges that his students face and the way they go about overcoming them.

Structure of Teaching Technology in Participating Schools

Technology in the New Zealand Curriculum consists of seven areas: biotechnology; electronics and control technology; food technology; information and communication technology (ICT); materials technology; production and process technology; and structures and mechanisms. Each school can teach one or more areas of technology based, in my opinion, on elements such the availability of teachers, appropriate classes, and financial support. Also, technology can be taught as a separate subject or across the curriculum, according to the policy of each school. Each participant identified types of technology taught in his/her school based on his/her knowledge.

In school (1) technology has been taught as a separate subject. Matthew mentioned that teaching technology in this school uses two methods: skill-based learning (40%) and

theory-based learning (60%). Similarly, school (2) applies technology as a separate subject which includes hard materials, electronic and control technology, and food technology. In this school, students are divided into groups. Each group learns one type of technology in each semester. Finally, in the third school, Angela and John identified the types of technology taught there, namely hard materials and food technology. During the first two terms, Year 7 students study hard materials while Year 8 students study food technology and vice versa in term 3 and 4. However it can be seen from their answers that some participants appeared confused about the types of technology. This confusion will be considered further in the discussion section.

Emerging Themes

The interviews contained a wealth of information on technology teachers' perceptions of teaching their subject. I present the relevant data here under the key themes I identified.

This section includes four headings which match with my research questions. Each heading includes the major themes, supported by appropriate quotations from the teachers I spoke to.

Uniqueness of Teaching Technology

All participants acknowledged that technology is a unique subject by expressing some of its features:

1- Technology moves students from abstract learning to constructive and concrete learning. For instance, Stephen referred to the importance of technology in the way that students learn something which is tangible rather than abstract:

> Hands on, hands on, they like to work with their hands. They like that.

2- Technology is a practical subject.

Angela saw the importance of technology in terms of being so practical and quite different from other subjects:

> I think because it is quite different and it is so practical and I think they enjoy that sense of achievement as well.

3- During technology classes, students can experience some challenges and they learn how these problems should be tackled. John indicated that technology encourages students to deal with challenges and processes that arise while they are designing projects:

> I like the challenges that they face and the way they go about it, just in general, the way they approach their projects, how they apply it and what they do.

Teachers' Understanding of the New Concept of Technology Education

Two teachers showed a good understanding of the new concept of technology education as defined in the most recent curriculum document.

For example,

1- The relationship between technology and technology education

Matthew showed a broad understanding of this concept when he defined technology education in general and technology in particular:

> Technology education is the global view and description of all the content which makes technology. But when you say technology, you are talking about one particular strand of technology education, so computing technology is a strand of technology education. Food science or food technology is one strand of technology and of technology education. So the best way to describe this is like a jelly fish, it is one jelly fish but it has many tentacles. All these tentacles make the jelly fish move in a certain direction.

2- In previous curricula, technology education was skill-based learning but it is currently theory-based. Matthew was also able to distinguish between the concept of technology in the past and today:

> Before it was a skill-based technology but today it is not a skill-based technology. Today it is purely a process based and a theory-

> based method….Previously it was technical education, not technology education.

3- Technology has its own theoretical framework.

Technology in the New Zealand Curriculum has its own theoretical foundation which shapes the new concept of technology. Some participants were able to express some strands of this concept. For example, Matthew mentioned that

> There are four branches: knowledge and skill; nature of technology; community and knowledge and skill; and technological practice.

Stephen was also aware of the concept currently implemented: he mentioned the nature of technology as an important strand of technology:

> I know that a new one has to be implemented now. For me it is the same, because they still have got the nature, they still have the knowledge, they still have the practice, it is only the theory. What they have built in is the nature, which I have to bring to my process.

However, the remaining two participants showed a lack of understanding of the new concept of technology education, although they were familiar with the 1995 document. Angela had difficulty understanding this concept and she did not mention the aspects of this problem but she said in general:

> I don't understand [the new concept of technology], this is pedantic… I just think it is hard to use.

Moreover, John did not have any idea about the actual year concept. His teaching was based on an understanding of the previous concept as defined in the 1995 curriculum. When I asked John about the 1995 document that includes the old concept of technology he said:

> Yes, yes, I have an idea about it.

But when he was asked about the New Zealand Curriculum document (2007a) which includes technology he said:

No, I do not have it.

How Were Teachers Addressing Aims of Technology In Classrooms?

Technology in the New Zealand Curriculum clearly identified the main goal of technology, which is for students to develop broad technological literacy (Ministry of Education 2007a). Interviewees' responses show the way that they express the aims of technology and also the ways of implementing technology into classrooms.

1- Technological literacy is one of this subject's goals

Matthew articulated that he wanted to help students to achieve technological literacy and he recounted the benefits of achieving this goal:

> Literacy is one of the key functions. If you have technological literacy or technology then it will benefit … first the person, then the business, and economically the country will benefit, and you will have the cutting edge over everybody else.

2- Teaching technology reflects on community

Stephen said that the aim of teaching technology is the contribution it makes to society by solving practical problems:

> The new document says actually you guide yourself towards it with your speciality or what is important in the community. For instance, this is an industrial area. You teach industrial subjects in terms of that, or if it is a farming type of community, you will teach more subjects which will help the farmer, that's the way I see it.

There is a similarity between Stephen's goal and Angela's goal in teaching technology which comes from the needs of the community:

> We tend to discuss a need, so the kids get a brief and often we make this up together. For instance, at the moment we are making mince and pasta. I say to the kids, 'why would a 12 year old kid want to work with mince and pasta?' So they say, 'Mum and Dad have got the flu, so we need to step in as kids at home.'

> It needs to be a healthy well-balanced meal so they then go away and look up what makes a healthy, well-balanced meal. So they spend maybe a block doing that, an hour and 10 minutes, to look at what makes a healthy meal, and then we look at managing resources, like the money and you know, looking at what is cheap and in season and that sort of stuff. They come up with the need of having to cook the dinner and then they have to manage the resources that they have at their house and so they plan to make this mince and pasta dish and the next is, they carry out and following from this, they have to evaluate it. So we move through breakfast, lunch, dinner, dessert and then snacks so that they will go away at the end of the session with at least two from each area.

3- Technology helps students to understand the inner parts of products and how are they connected. For instance, Stephen saw the goal of technology as follows:

> Students can understand where parts fit into the whole development, where the connection is.

In terms of addressing these aims in classrooms, the goals of technology were addressed by some participants in two ways:

1- The goal was for students to reach the achievement and unit standards.

Matthew discussed technology education in this way and explained it as:

> Now there are two different ways technology education is delivered. One is called an achievement standard and one is called a unit standard. In a unit standard it is Unit of Work which deals with a specific issue in that product or process. Achievement standards deal with the same specific product or process but it meets wider competency skills, wider thinking skills. In a unit standard it is only a step by step process and it finishes. So when we deliver the unit standard, what we say to the student is, if you do unit 1 to 883 you should be able to input data, you should be able to compose dialogue on the keyboard and you should be able to read and write on it. But if you do achievement standard 1.1 which is the same as a unit standard what we are saying is this is the objective.

2- The goal was for students to develop certain thinking skills. Stephen talked about the aim of technology being to teach thinking skills:

> The thinking skills are used, so it is not just work, so they work it out, they research it, they come with the final product. You can see it is all there. They go preliminary, and then they go to the final and then evaluate it. So you can see all the thinking skills are there.

How Teaching Technology Affects Students' Technological Literacy

All participants observed that student understanding of and ability in technology has improved as a result of teaching this subject. All participants were asked the same question: Does the teaching of technology improve students' technological literacy? Their answers have been divided into two points:

1- Teaching technology made a big positive change on students' technological literacy. Three participants expressed:

> "Yes, and it has made big improvement." (Matthew)

> "Yes, yes absolutely…when I arrived here, they actually had no idea what technology is." (Stephen)

> Yes, my students have good technology literacy. (John)

2- The speed of students' learning

Angela, who is a new technology teacher, observed that students learn so much in six weeks:

> I can answer that, because when you start with a group of kids at the beginning of the cycle, they are with you for six weeks and when the kids walk in here for the first time, you just about have to walk them through every practical bit. At the end of six weeks, they go and you get a new group and you don't quite realise how much that first group had learned until that new group comes in and you start all over again and you go "wow".

Difficulties in Teaching Technology

This study found that there are some difficulties facing technology teachers in regard to teaching technology.

1- Financial issues.

Angela and John both identified an insufficient budget as a key obstacle to them in teaching technology:

> Budget, would be the one. (Angela)

> I mean, my budget, I have not had an increase for about 8 years…. you would find most technology teachers in my situation, are out 'bludging' all the time. You ask for stuff … It makes it difficult; you are trying to get as much stuff as you can get and we never get enough, anyway. Computers is one thing, we are always looking out for someone who is chucking out their computer. We fix them up and use them, so you are always looking for stuff. (John)

2- There were no meetings for technology teachers.

Angela and John mentioned that they did not meet their colleagues to exchange experiences because there were no meetings for technology teachers organised by the Ministry of Education.

> I have not met my colleagues in this area. (Angela)

> There are no classes for technology; we are becoming a dying breed. (John)

3- Disappearance of senior teachers

John raised a critical issue, which is that the Ministry of Education stopped supporting the continuance of senior teachers who were helping hard materials teachers:

> All the hard materials and all those things have their own senior teachers who will organise courses every year, but the Ministry has stopped all that and there are no longer any senior teachers so there are no longer any courses…no senior teachers makes me feel ancient.

4 - The complexity of the concept of technology

Matthew demonstrated that teachers were confused in distinguishing between the strands of technology in the New Zealand Curriculum:

> The first issue is, understanding the relationship between the three strands from one technological strand to another. There is internal friction between the different strands. For example the design technology teacher, woodworking technology teacher, food technology teacher and information technology teacher each see the strands and the relation between them in different ways.

5- The time table issue:

Matthew revealed that the limited time available in the school week for teaching technology imposes on teachers a need to get through their material as soon as they can. This means that students are only able to gain a glib understanding of the subject:

> Because there is limited time, you can have the students for only 40 hours a year, 14 weeks a year and you can only have a timetable of 194 days, so you have to deliver the best you can.

6- Student concepts of technology are at odds with the teachers' intentions

An academic background and long experience allowed Matthew some authority in teaching technology. He reported that students became reluctant to attend technology classes when they realised that the reality of this subject was at odds with their preconceptions about the subject. This was particularly true of ICT classes:

> Students take computing and information technology because they think it is all for playing games. When they come in they realise that there are no games here, it is all for learning software and other skills. So the novelty wears off. The early years, in Years 9 and 10 when the students come in, they take the course for the novelty. By the time they come to Year 11 it is far more theoretical than they can even imagine. By the time it comes to Year 13 from 100 students boil down to 20. Therefore you are getting the poor students to end.

Teachers' Suggestions for Improving the Teaching of Technology

This study not only aimed to disclose the difficulties that faced teachers in teaching technology but it also aimed to show some suggestions given by participants that might help decision-makers at the Ministry of Education to develop technology in New Zealand schools. These suggestions are:

1- The amount of time dedicated to teaching technology should be decided by each school

Matthew talked about the limited time given to technology and he suggested that each school should decide what amount of technology is going to be taught to students. Based on that, the allocated time for teaching technology will be predetermined:

> What percentage [of time spent teaching technology will make] a great technologically literate school? If they want to be a 90% technologically literate school, then everything the school will do, design a timetable and unit standard and the 10% key competencies, which you must get. It is very hard to get, for how can you become 90% technologically literate? It also means that you become a technical school, where you teach theory. If you become a 90% academic school, 10% sports, you have no exposure to technology.

2- Providers of technology should work together

Matthew also suggested that there are three providers of technology in New Zealand who should work together to support the concept of technology. These providers are: the Ministry of Education, the commercial sector and schools personnel (technology teachers and directors of schools):

> So if they work together, they will support this concept and the concept of technology education in school will succeed.

3- Maintaining professional development

Professional development was highly recommended by Matthew, Stephen and John as a contributory factor in developing teachers' skills:

> [Professional development is] 100% important. Everybody teaches at 100%, [it is] 100% important. It is not something you can take lightly. Personal development in the school, whatever type of development, commercial development, external exposure is equally important and national and international exposure for professional development. (Matthew)

> Yes, I would say technology is the teacher because the teachers need to know what technology they need. My suggestion is that they [Ministry of Education and universities] should actually work hand-in-hand with the technology teacher, not separately. (Stephen)
>
> The Ministry of Education should think about bringing senior teachers back to help technology teachers. (John)

4- The budget for technology should be increased.

Two of the participants, Angela and John, suggested that the budget should be increased to help them get much-needed equipment, and they answered 'yes' when I asked them if they felt the budget should be increased.

5- Between 16 and18 students is the ideal number in technology classes.

The number of students in technology classes was considered by three of the interviewees as a key factor that might influence their teaching. They believe that more than 24 students cannot be easily managed.

> You cannot control more than 24 students. (Stephen)
>
> 24 students, this number can be managed. (Angela)
>
> We try to put a ceiling in these rooms of 24....24 students: this number can be managed. (John)

However, they believe that the ideal number is between 16 and 18:

> 16 to 18 is great. (Stephen)
> The ideal number is 16-18. (Angela)
> The ideal number is 16-18. (John)

6- Participants' opinion as to whether technology should be taught in Saudi schools

One of my research goals was to see the perspectives of participants on the issue of whether technology should be taught in Saudi Arabian schools. All participants said that technology should be taught in Saudi schools:

> 100%. Why 100%? Because Saudi Arabia is a key-player in certain political situations. That leads it and Saudi Arabia has the financial capabilities to deliver anything they want. Saudi Arabia needs to be at a pace with the world-class level in order to maintain the cutting edge. (Matthew)
>
> Oh, any time, [you can teach technology in your own country schools] but you have got to go and look at, I think, Queensland. They are ahead of us. They had it before we got it. They already have had it in for two years. You want to go there, I think. They are really doing it. (Stephen)
>
> Yes, without doubt. (Angela)
>
> Yes, it is good idea to teach technology in your country. (John)

Conclusion:

The findings demonstrated in this chapter have been identified for each participant. In addition, the findings identify some themes of technology teachers' perceptions of technology and technology education in New Zealand. Furthermore, teachers' perceptions in this study were affected by a change that has happened to technology education since 1995 in general and after 2007 in particular elements. How does this change affect teachers' perceptions of technology? These themes will be discussed in the next chapter and appropriate literature referred to.

Chapter V: Discussion of the Emerging Findings

In this chapter, themes emerging from the data are discussed. The importance of teaching technology was firmly stressed by all participants. The new concept of technology has been integrated into the selected schools, but each interview participant has had his or her own understanding of this concept and they address aims of technology based on their respective understandings. This study found that teaching technology had a significant influence on students' technological literacy (according to my interview participants[1]). Some difficulties faced by the participants in teaching technology were revealed. Finally, teachers' suggestions to improve teaching technology will be discussed in this chapter.

Uniqueness of This Subject

The participants in this study presented their perceptions of teaching technology in New Zealand schools. All of the teachers believed in the importance of their subject. For example, Stephen asserted that students like to work with their hands and stated that technology is able to offer them something tangible. Similarly, Angela believes that students enjoy learning through technology because this subject helps them to deal with tangible products; she described technology as practical learning.

Stephen's and Angela's views reflect the first strand of technology education in the New Zealand curriculum which is *Technological practice* (Ministry of Education, 2007b). This strand includes three components: brief development, planning for practice, and outcome development and evaluation. Through the third component (outcome development and evaluation) the Ministry of Education (2007b) explained that students can develop technological outcomes (product or system) or any other outcomes of technological practice, concepts, plans, and models.

Moreover, John's view of the importance of technology implicitly illustrates that technology creates some challenges that help students to learn how and why things work and how they apply it. This principle was clearly identified in the third strand of

[1] See: Students' Technological Literacy later in this chapter

technology which is *Technological knowledge* as mentioned in the literature (Ministry of Education, 2007b), particularly in the first component of technological knowledge which is technological modelling. Through this component, students can explore and classify the difficulties and influences on the development of any product.

Technology Teachers and the New Concept of Technology Education

Teachers' understanding of the new concept of technology education is as crucial as their knowledge of technological activity in enabling them to convey technological knowledge to students. This study found that two participants had a good understanding of the current concept of technology and two did not.

The two teachers I interviewed who did have a good understanding came from an academic background, unlike the two that did not. For example, Matthew's academic experience helped him to clearly distinguish between technology and technology education, and also to compare the concepts of technology in the past with those of today. Matthew explained that technology is a process of technology education: "technology education is the global view and description of all the content which makes technology". Matthew's explanation reflects the definition of technology education and technology provided by (Ministry of Education, 1995, 2007a).

Matthew also mentioned that teaching technology in the past was merely a skill-based technology. Moreover, he emphasised that teachers were primarily teaching practical methods, which then led to comprehension of some of the underlying theory. Matthew's explanation reflects how technology was taught in the past and supports findings in the literature. Harwood (2002) indicated that during the second era in the development of technology in New Zealand schools (1975-1995) there was less emphasis on theory and more on practical application. Jones and Compton (1998, p.53) attribute this to the fact that teachers did not then have the ability to view and reflect on their practice from a technological perspective due to "the non-consensual nature of technology education held by teachers". In contrast, Matthew revealed that today he and his colleagues have been

teaching a theoretical subject, "but today it is purely process-based and theory-based". This means that he recognises the new concept of technology that has been developed based on a theoretical foundation.

A theoretical foundation for technology provides teachers with the following Ministry of Education-defined strands: *Technological practice, technological knowledge, nature of technology* (Ministry of Education, 2007a) that help them to change their way of teaching from practical into theory-based learning. This study found that this theoretical foundation was clearly understood and implemented by Matthew and Stephen in schools 1 and 2. This indicates that there has been a change from practical-based learning to theory-based learning. For instance, Matthew identified three strands of technology: knowledge and skill, nature of technology, and technological practice that reflect the structure of technology in New Zealand in the literature (Ministry of Education, 2007a). Similarly, Stephen recognized that the concept of technology has changed. He explained that today's subject of technology draws on a new concept of technology but still has the knowledge and practice of yesteryear: the major change was about including the nature of technology as the third strand of the concept of technology.

Research into the history of technology in the New Zealand curriculum shows that a major development in the concept of technology emerged between 1995 and 2006. Some of the interview participants kept up with these changes and some did not. Matthew's and Stephen's definitions of the concept of technology matched those in the literature perfectly.

Technology in the New Zealand Curriculum 1995 (Ministry of Education, 1995) included three strands of technology: *Technological knowledge and understanding*, *technological capability,* and *technology and society*. However, it was decided that this concept should be reviewed to remedy the gaps in terms of technological practice. Thus, a new concept of technology emerged with its three new strands: *Technological practice*, *technological knowledge,* and *nature of technology* to "move technological literacy away from a "functional" orientation to a literacy that was "laboratory in nature" (Compton & France,

2006b, p.1). In agreement with two studies conducted by Jones and Compton (1998) and Jones and Moreland (1998), my study found that some teachers' awareness of the concept of technology as a learning area was evident and clearly influenced by a modified theoretical foundation of technology that has now been implemented.

Angela and John were familiar with the old concept of technology (Ministry of Education, 1995) and although their schools had received the new curriculum, they had not been 'informed' about the new concept in the New Zealand curriculum (Ministry of Education, 2007a). For instance, Angela did not have any idea about the new concept and she also she had difficulty in understanding the 1995 concept. She said that she found such discourse "pedantic". Angela's situation may be attributed to her lack of experience in teaching technology (she had only been teaching for ten weeks at the date of the interview), or be a lack of professional development. In contrast, John revealed that he had not received a copy of the New Zealand curriculum (2007a) and that he had been teaching based on the 1995 curriculum.

Angela found some difficulties in understanding the new concept of technology. Her perceptions are similar to some teachers' perceptions in a study conducted by Jones, Harlow and Cowie (2004) who found that 50% of teachers of students in Years 9-13 faced difficulties in understanding the concept of technology at that time.

Consequently, my study found that there has been a lack of professional development amongst some technology teachers, and the efforts of the Ministry of Education should be scaled up to inform technology teachers about the New Zealand curriculum (Ministry of Education, 2007a) which includes technology as a separate learning area. The Ministry should also to help teachers become involved in professional development programmes in terms of technology. The most useful changes for the curriculum document would be to make it simpler to understand for technology teachers from a non-academic background, and to include better-developed learning and assessment examples.

How Were the Aims of Technology Implemented?

In this study, participants had different perceptions about the aims of technology in classrooms. Two participants, Matthew and Stephen, explained the aims of technology in terms of the theoretical aims laid out in the curriculum. However Angela and John only provided their personal practical aims, with no reference to theoretical underpinnings. Such a difference is in my opinion attributable to the lack of professional development.

Matthew linked the aim of technology with current technological literacy. His goal in teaching technology is to help students to achieve technological literacy. He commented that achieving this goal will benefit society. He believed that the individual, business and the country as a whole all benefit from this subject. In addition he explained the two ways that he addresses the aims of this subject, through achievement and unit standards.

In contrast, Stephen said that the aim of teaching technology is to help students to understand the whole development of any product. He tries to teach students to fit parts into an appropriate position in the product and to recognise the points of connection between parts of a product that they have made. Stephen also said that he addresses aims of technology based on the needs of community. He gave examples of how technology helps industrial subjects and the farming community. Similarly, Angela believes that her goal is to help society through teaching students how to cook healthy food.

By comparing the participants' perceptions of the aims of technology in classrooms to the aim of technology articulated in the New Zealand curriculum in the literature, this study found that the participants explained the aims of technology in more detail than the 1995 and 2007a curriculum documents. These documents present a general aim (1995, 2007a). Compton and France (2006) revealed that the overall aim of technology has not been changed since 1995. It remains focused on developing students' technological literacy. The 1995 document articulated the aim of technology, which was to enable students to achieve technological literacy through the development of technological knowledge and understanding, technological capability, and technology and society.

When I asked the interview participants for the general goal of technology teaching, they all gave various and detailed responses, rather than a summary of the goal stated in the New Zealand curricula for both 1995 and 2007. I had a sense they were getting lost in the details and that a clearer understanding of the general goal would help them to plan more effectively.

I will now link the teaching goals that my participants identified with the aims and strands of technology in the New Zealand Curriculum 2007 as follows:

Matthew addresses the goal of technology in a way that reflects the third strand of technology which is *nature of technology*. Through this strand, students explore how developments and outcomes are valued by different people in different times and become increasingly able to engage with current and historical issues and to explore future scenarios (Ministry of Education, 2007a). Moreover, Matthew achieves the aim of technology in both the Unit and Achievement standards. By matching them with the three strands of technology, this study found that they reflect two components of the *technological knowledge* strand: technological system and technological product. (A Unit Standard deals with a specific part of a product and explains how parts work together "to control the transformation of materials, energy and information" (Compton & France, 2006a). In contrast, an Achievement Standard is an application of technological products that aims to understand the relationship between the properties of material and their performance capability in order to understand and develop any project. In other words, a Unit Standard means the relationship between parts of any product itself and how they work together whereas an Achievement Standard means an understanding of the relationship between characteristic of any product and its performance that leads to develop this product in the future.)

Stephen brings the goal of technology into classrooms based on the needs of the community, and his method to implement this goal reflects technological modeling which is the first component of the *technological knowledge* strand. Compton and France (2006) explained that technological modeling is the entire development of a product, including

functional modeling and prototyping. Through functional modeling students can continue an evaluation of design concepts, and prototyping helps students to evaluate the fitness for purpose of the technological outcome. This reflects Stephen's idea of teaching technology, which is "to help students to understand the whole development of any product". Likewise, Angela's and John's approach in teaching technology reproduces the technological modeling component.

Students' Technological Literacy

An overall aim of introducing technology in the New Zealand curriculum is to enable students to achieve technological literacy. This study aimed to answer this question: What are the influences of teaching technology on students' technological literacy?

This study found that all participants believed that teaching technology in their schools played a prominent role in developing technological literacy of students. For example, Matthew answered that technology had made a big improvement of his students' technological literacy. Angela and John also believed that there was rapid development in students' technological literacy in terms of food technology and hard materials technology. For example, Angela observed that the first group of her students who were studying food technology learned quickly, within the first six weeks. From the literature, it can be recognised that technology contributes to developing students' technological literacy. A study by Jones, Harlow and Cowie (2004) found that 64% of teachers believe that technology helps students to develop technological literacy, particularly in communication and problem-solving skills.

Therefore, my study established that there has been a development in students' technological literacy in the schools selected for my study, and that teaching technology as a separate subject is an appropriate way to help students deal with the so-called 'technological revolution'. However, some previous studies (and also this study) found that there are some difficulties faced by technology teachers and that these must be resolved before technology's full benefit can be assessed. These issues are discussed in the next section.

Challenges of Teaching Technology

There is no doubt that the existence of difficulties in any project is a normal matter. These difficulties frequently emerge with new projects and we should work with them to find appropriate solutions. The current concept of technology as it should be taught in New Zealand schools is a new concept that is still in the process of being integrated by teachers into their pedagogy. This study aims to demonstrate some difficulties that currently face technology teachers as they go through this process.

Three participants experienced some difficulties in teaching technology. The first was related to insufficient funding. For example, John indicated that his school's budget has not been increased for eight years. His answer in my opinion gives the message that there was not an evaluation of an allocated budget for technology in his school and he was not informed about the reasons behind the delay in increasing this budget. He mentioned that he always looks for second-hand devices which could be fixed and used in technology classes. Similarly, Angela believed that an insufficient budget is one of the difficulties that she faced in teaching technology.

Establishing an organisation or a group for technology teachers is a very important factor that can help them to meet their colleagues and to exchange experiences. However, technology teachers in this study mentioned that there were no meetings and no mentorship process between experienced and new teachers. One of the participants even described technology teachers as "a dying breed". John claimed that the Ministry of Education stopped senior technology teachers from organising courses to help newer teachers.

I argue that organising meetings between technology teachers in the same area or even throughout Auckland would be the best way to have all technology teachers together to discuss all the issues related to their subject. Senior teachers would contribute in organising and providing technology teachers with current ideas about technology. At the same time one can argue that schools are performing the same role as the Ministry of Education, which can offer such senior teachers time to train (or help) other technology

teachers. I would argue that organising training programmes for technology teachers needs seniors who have free time. Further, not all schools have senior teachers in technology. And those who are in other schools have many commitments that prevent them from undertaking such a task.

Another issue faced by technology teachers is that teachers perceive the nature of the three strands of the concept of technology in different ways. In fact, the strands of technology are separate but should be understood as a unit that comprises the concept of technology. Compton and Harwood (2005) emphasised linking the aim of technology to the interrelated learning strands. Participant Matthew suggested that there is internal friction between the different strands because each teacher has their own perception of them.

Based on the literature I have read and agreed with, this issue results from teachers' different views of the practice of teaching (Paechter, 1991, Harwood, 2002) and their different skill sets in technology.

I agree with Jones and Compton (1998) who revealed that teachers reflect on their practice from their own point of view and their particular understandings based on their particular skills. I would make clear that nature of technology in this case means the whole concept of technology that includes the three strands and an understanding of how are they linked. Consequently this study emphasises the importance of explaining the theoretical framework of technology to technology teachers in order to help them remove unclear understandings of the concept of technology. This study also asserts that without a good understanding of the theoretical foundation of technology this concept will remain inside the New Zealand Curriculum guide rather than in actual teaching practice.

Additionally my study found three further obstacles that face technology teachers. These issues are: the limited time for teaching technology, a shortage of required equipment and student perspectives on technology (for example, Matthew said that many of his students think that technology learning is only about having fun playing on computers). In comparing these findings to the issues in the literature, this study found that the first two

issues were not reported by any earlier study. For example, allocated time for teaching technology in school (1) was 40 hours per year, which means it was taught for 14 weeks. Matthew believes these hours are not enough to deliver this subject. Also, he mentioned that students are reluctant to attend ICT classes (as one of the applications of technology education) when they realise that the purpose of ICT is not games but for learning software and other skills based on theory.

By examining the literature, it can be seen that the third aspect has been discussed. A study conducted by Jones, Harlow and Cowie (2004) identified four major challenges for technology teachers: insufficient equipment to implement technology; introducing technology adds another burden on teachers and causes 'crowded curriculum'; a lack of professional development; and difficulties in understanding the curriculum. Jones, Harlow and Cowie's study justified why specialist technology teachers of Year 7-8 students found difficulties in teaching technology based on the 1995 document. Specialist technology teachers who have experienced the conventional subject areas of cooking, sewing, and woodwork/metalwork now have one blended technological concept. So teachers said that they found it difficult to integrate the traditional skills that were an important element of how they used to teach with the current technology curriculum. This is, in my view, attributable to a lack of understanding of the theoretical foundation of technology. This has caused confusion amongst technology teachers who "have been resurrected from typing teachers to IT teachers, from carpenters to constructors and metal workers to hard material" (Gass, 2007).

By comparing my study's result in this aspect to Jones, Harlow and Cowie's study (2004) it can be seen that two key difficulties emerge, namely insufficient equipment to implement technology, and a lack of professional development, which causes a difficulty in understanding the framework for technology.

In addition my study found three issues not reported in the literature, namely failing to support senior technology teachers to mentor junior teachers; insufficient budgets; and a failure to hold meetings between and among technology teachers. While the Ministry of

Education may need a long time to provide professional development to all technology teachers, I believe that encouraging and organising meetings between technology teachers based on a clear plan would be helpful to spread the new concept of technology among all technology teachers.

Suggestions to Improve the Teaching of Technology

Throwing issues on to the reader is not the aim of this study. Rather, I will endeavour to provide some solutions (suggested by my research participants) as a contribution to improving teaching technology in New Zealand schools.

Technology as a separate subject is not easily delivered in a short time, even through a year, to all students. Technology has many applications, such as food technology, hard materials, ICT, electronic and biotechnology. Each branch needs considerable time to be properly delivered to all students. Thus, Matthew suggested that the current timetable of technology did not help students to acquire technology's full benefit. He suggested that each school has to decide its position towards technology as a separate subject if it wants to be a 90% technologically literate school, then all its activities should be directed to achieve this goal. There may be some truth in this but I would argue that the aim of technology in New Zealand is not to provide students with all detailed information about technology but to help students achieve technological literacy through the development of technological strands (Ministry of Education, 2007a).

Matthew also suggested that three providers—the private sector, the Ministry of Education and teachers—should work together to achieve the goal of technology. I agree with Matthew; I think such cooperation gives an opportunity for students who are interested in a particular type of technology to be invited by the private sector to learn more and concentrate on one particular product.

A need for professional development was emphasised by three participants to expand their knowledge about the new concept of technology. This study found that half of participants did not have any idea about the new concept of technology, and they had

been referring their teaching to the 1995 document. The literature also stresses the importance of professional development. A study conducted by Compton and Jones (1998) supported the idea that a professional development programme helped technology teachers to develop their understanding of the concept of technology: 63% found the programme assisted them with their understanding of the concept of technology. Also Compton and Jones (1998) suggested a content of professional development which includes six features as mentioned in the literature. Therefore, my study confirms that there is a need to increase the efforts to spread the new concept of technology which is slightly different from the previous one[2]. Also it confirms that their prior experience about the 1995 document will effectively assist them to understand and accept this concept.

In my study, one teacher had a difficulty in understanding the concept of technology. This issue may be attributed to Angela's short experience in teaching technology. In 2004, Jones, Harlow and Cowie reported that technology teachers experienced some difficulties in understanding the concept of technology in the 1995 document. Those researchers found that 50% of teachers of year 9-13 students wanted to change the structure of the technology curriculum statement. The most popular changes would be 'making it simpler to understand' and 'including better developed learning and assessment examples'. I believe that one of reasons behind such a statement might be lack of theoretical understanding (resulting from a lack of professional development), the presence of which has been reported since the first official draft of technology in 1995 until the date of my study.

Conclusion:

The participants involved in this study were positive about teaching technology as a separate subject. They involved students in different activities related to technology such as food technology, hard material, ICT, and electronic. Each teacher had his or her own perceptions about the aim of technology and methods of addressing this aim in

[2] See the Literature Review for more on the differences between the two concepts of technology in the 1995 and 2007 curriculums.

classrooms. In fact, some of the responses were merely minor details of the general aim of technology with no connection between these details and the framework of technology in the New Zealand curriculum.

Teachers were positive about the role of technology in promoting students' technological literacy despite the difficulties they faced in teaching technology, which led them to raise some useful points of view to improve technology in their schools.

In Chapter VI, I present my conclusions from this discussion. In addition, I identify the strengths and limitations of my study, its implications, and suggestions for future research.

Chapter VI: Conclusion

This chapter will give an overview of the significant findings that were discussed in depth in the previous chapters. The strengths and limitations of this study are also discussed. The implications of the findings of this study conclude with suggesting possible future research. Finally, this chapter includes the possibility of teaching technology in Saudi schools, which was suggested based on the contents of this study.

This research aimed to address the following question and four further questions that emerged:

Original question:

What are teachers' perceptions of technology education and the subject of technology that has recently been included in the New Zealand Curriculum?

Four further questions:

- How do the teachers address the aims of technology in New Zealand Curriculum in practice?
- What are the influences of teaching technology on students' technological literacy?
- What are the difficulties that teachers might face implementing technology in classrooms?
- What would teachers suggest for improving teaching technology in schools?

The findings presented in this dissertation show teachers' perceptions of technology education and technology through:

- their views on the importance of teaching technology in New Zealand schools,

- the way that they address the aims of technology in classrooms based on their understanding of new concepts of technology education,
- the effect of this subject on their students' technological literacy,
- their identification of some difficulties that face teachers of this subject,
- their suggestions on how to improve teaching technology in their schools.

Teaching technology as a separate subject was seen by my research participants as important. They believe that technology classes help students to apply technological principles (a theoretical foundation of technology) into practice through providing students with a process by which to learn how to design technological products. This is expected to reflect on students' technological literacy, which is the aim of technology in the 1995 and the 2007 New Zealand curricula.

Two the participants were aware of the new concept of technology education that has recently been implemented in the 2007a Curriculum. One said that an academic background helped him explain the new concept of technology education and compare it to the previous concept. Professional development assisted another participant to distinguish between the old and new concept. However the other two participants were unaware of the new concept of technology education, although they were aware of the old concept of technology found in the 1995 New Zealand Curriculum.

The findings also revealed that an academic background and professional development helped participants to address the aim of technology in the classroom. The two participants that could describe both the aims of technology in the 2007 curriculum and their personal strategies for applying them in practice had academic backgrounds, while the other two participants (who could only describe their personal aims—not the aims set out in the curriculum) did not. However, none of the participants named the overall aim of teaching technology in the both the 1995 and the 2007 curricula (namely: "to develop students' technological literacy.").

This study only investigated teachers' opinions about the role of teaching technology to improve students' technological literacy. It did not investigate what happens in practice, only what teachers expressed as happening. The teachers I spoke to expressed that their students were able to understand what technology means. Teachers observed that students learned the processes and requirements that are necessary to design a technological product.

This study found that there were some difficulties facing technology teachers, namely:

(1) insufficient resources, including funds

(2) a lack of support, including mentoring of junior teachers, and senior teachers

(3) a lack of regular meetings for technology teachers

(4) insufficient professional development

(5) confusion among some teachers as to the nature of the new concept of technology

6) timetable issues

This study found that the first three of these obstacles were not reported in the literature but the other three emerged from the research and were reported in the literature.

The research suggested that budgets should be annually reviewed to help teachers and to provide the required equipment. Also schools or the Ministry of Education should organise meetings between technology teachers to provide them with peer support and possible mentoring.

Finally, this study aimed to provide some suggestions from participants as to how to improve technology in New Zealand schools. Despite the efforts by the Ministry of Education to help technology teachers understand and apply the new concept of technology, half of the participants in this study did not understand it well. My conclusion is that the Ministry of Education and school administrations should encourage technology teachers to participate in further professional development activities related to technology and technology education.

Strengths and Limitations

My study has several strengths:

1- It applies an appropriate methodology in exploring teachers' perceptions of technology. Applying a case study provides depth of data
2- It identifies real teacher opinions about teaching technology in four cases in participating schools
3- It makes a contribution to the sparse New Zealand literature about teachers' perceptions of technology and technology education after 2006. This study is believed to be the first study that discusses this topic from 2006 onwards.
4- It provides the opportunity for technology teachers' voices to be heard and for them to show their perceptions of technology in their schools
5- It means a lot to me personally and has added to my professional development. I decided to study technology education in New Zealand to understand New Zealand's experience in technology education. Therefore, this study was conducted to provide me with an understanding of technology education, how has it been taught and structured, the possibility of implementing it in Saudi Arabia, and the difficulties that might face us in implementing this project

Although this study might be the first to explore that the perceptions of technology teachers after 2006, the findings need to be considered with some caution. There are limitations to the study which have to be recognised, especially when making generalisations.

This study was conducted in three schools which include Year 7-10 students, with a small number of respondents: four teachers. Technology teachers in other schools may not have the same issues, particularly professional development, budget and the timetable for technology as a subject. Moreover, neither assessment nor actual teacher practice were explored, despite their importance as indicators of teaching effectiveness.

Despite these limitations, this study has provided me with ideas about some teachers' perceptions of technology. It has helped me to follow the development of technology in New Zealand schools and think about how such a project could be constructed and developed elsewhere. If the Ministry of Education in Saudi Arabia decided to implement a technology education project in its schools, this study will help me to make links with technology education experts in New Zealand. Also it highlights some issues related to teaching technology that need consideration by decision-makers in the Ministry of Education in New Zealand. I hope that this study may help technology teachers to expand their understanding of technology and discuss this concept with their colleagues.

Implications

Based on the findings of this research, what recommendations can be offered to remedy the issues raised in this study? I suggest that the findings in this study emphasise the need for greater attention to some aspects in teaching technology in New Zealand schools. The findings of this study might enhance the awareness of decision-makers and school principals in the several ways:

One solution to the problems that face technology teachers in teaching this subject is, in my view, ongoing professional development which helps teachers to be more familiar with the new technology framework. The Ministry of Education could work with universities and the private sector (training centres) to spread the new concept of technology more effectively. Experts could be invited to explain the concept, and senior teachers could be drawn in to demonstrate its practical application.

In addition, regular meetings between technology teachers might help to improve teachers' understanding of the new concept. At these meetings useful practical lessons could be given. Senior teachers should be encouraged by the Ministry of Education to provide new technology teachers with the benefit of their experience in teaching technology. This might be organised by schools in each educational district. The Ministry of Education could provide schools with a list of specialist teachers in their area who could mentor other teachers in some way.

Suggestions for Future Research

This study provided me with a range of possibilities for further research.

A good understanding of the three strands of technology- technological practice, technological knowledge and the nature of technology- and how these strands are integrated is the core of the concept of technology in New Zealand schools. Such understanding will help teachers to plan effective assessment procedures. I would like to continue my study in this area. If the opportunity arises, my future research will probably investigate technology teachers' perceptions of the three strands of technology in New Zealand, exploring in depth three points: teachers' understanding of the three strands, how these strands are integrated in teaching, and how they are used in students' assessment. The methodologies might involve interviews with technology teachers and observations of how teachers actually teach in the classroom. The gaps between the framework of the three strands and how teachers practice them in classrooms could be identified and the ways to remedy these gaps discussed in order to improve teachers' understanding and practice of technology in classrooms.

Other areas of possible research would be to investigate the factors that help teachers to best introduce technology into Saudi schools. The Saudi Ministry of Education has been working hard to develop its educational system and the possibility of teaching technology is one of the steps in this development. Many countries have introduced this subject as a separate subject based on their circumstances and their philosophy of society. Thus, my future research might investigate this aspect to identify factors that should be taken in account before starting such project.

I hope that other researchers will extend my study and conduct it on a larger sample of technology teachers. Those researchers might use more than one methodology to help provide a whole picture of teaching technology in New Zealand schools.

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Appendices

Appendix A: Participant Information Sheet

Project Title: New Zealand Teachers' Perceptions of Technology and Technology Education.

An Invitation

My name is Abbad Almutairi. I am on a scholarship from the Ministry of Education (Saudi Arabia). I have worked as a supervisor of technology education (ICT) in the Ministry of Education in Saudi Arabia. Now I am doing a Master's degree in Education at AUT (Faculty of Applied Humanities, School of Education). This is part of the requirements of obtaining the degree. I intend in this research to investigate "New Zealand Teachers' Perceptions of Technology Education" and this is the title of my project. I am pleased to invite you to be a participant in my research and your participation will contribute to develop my understanding of Technology Education in New Zealand schools and help me in obtaining my qualification. I believe that your participation will be useful for you in providing an opportunity to reflect on your professional work. Your participation is entirely voluntary and you may withdraw at any time prior to the completion of data collection.

What is the purpose of this research?

This research helps me in understanding New Zealand teachers' perceptions of technology Education. Their precipitations will provide me with an overview of technology in NZ schools which includes the pedagogy of technology, impacting of technology on students' technological literacy, the difficulties that might face technology teachers in teaching technology and suggesting ideas on how technology education might be improved in NZ schools. In addition, this research aims to identify any gap between theory and practice concerning teaching of technology in NZ schools. Results of this research might help decision-makers in NZ to understand the real situation of technology as a separate subject in schools. Finally, this research will help me to test the possibility introducing technology as a separate subject in Saudi Arabia.

How was I chosen for this invitation?

You are one of the participants who have been chosen to be involved in this research. I have used a convenience sampling which means your school is reasonably close to my home, and I understand that your school offers technology education. This research is directed to technology teachers year (7-10) students. Four technology teachers will be involved from up to 4 schools.

What will happen in this research?

I will use interviews as my data collection method. During the interview, you will be asked some questions regarding this topic. You and I will discuss these questions in order to understand your perception of technology in your school.

What are the discomforts and risks?

There are no known discomforts and risks.

How will these discomforts and risks be alleviated?

If you feel uncomfortable talking with me and you are free to withdraw at any stage, and your interview notes will be destroyed.

What are the benefits?

I believe that this study will contribute in evaluating technology in your school and in NZ. The results of my study will help me to understand your perceptions of technology and help me gain a degree. Decision-makers in the Ministries of Education in New Zealand and in my own country Saudi Arabia may benefit from this study in developing technology in the future.

How will my privacy be protected?

Your identity and the identity of the participating schools will not be disclosed in my report. Also, your principal will not be informed that you have agreed to participate. All data will be saved in a locked cupboard for six years at Postgraduate Program administrative office. Your consent form will also be stored for 6 years in another locked cupboard at the postgraduate office.

What are the costs of participating in this research?

No costs are expected apart from the 60 minutes for the interview.

What opportunity do I have to consider this invitation?

I would like you to email me at (abbad_almutiri@hotmail.com) within a week to tell me whether or not you are happy to be involved.

How do I agree to participate in this research?

If you agree to be involved in this research, you will need to sign a consent form. I will bring this form to the interview.

Will I receive feedback on the results of this research?

Yes, your transcription will be returned so you can make any changes you wish to, and then later on request I will provide you with a summary of the study.

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

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor:

Associate Professor Andy Begg:
email: Andy.begg@aut.ac.nz
tel: 9219999 ext, 7355

Concerns regarding the conduct of the research should be notified to the Executive Secretary, AUTEC:
Madeline Banda:
email: madeline.banda@aut.ac.nz
tel: 921 9999 ext 8044.

Whom do I contact for further information about this research?

Researcher Contact Details:
Abbad Almutairi
cel: 021381400

Project Supervisor Contact Details:
Associate Professor Andy Begg
email: Andy.begg@aut.ac.nz
tel: 9219999 ext, 7355

Appendix B: Consent Form

Project title: **New Zealand Teachers' Perceptions of Technology and Technology Education.**

Project Supervisor: Andrew Begg

Researcher: Abbad Almutairi

- I have read and understood the information provided about this research project in the Information Sheet dated / / 2008.
- I understand that my identity and my school will not be revealed in the research report
- I have had an opportunity to ask questions and to have them answered.
- I understand that notes will be taken during the interviews and that they will also be audio-taped and transcribed.
- I understand that I may withdraw myself or any information that I have provided for this project at any time prior to completion of data collection, without being disadvantaged in any way.
- If I withdraw, I understand that all relevant information including tapes and transcripts, or parts thereof, will be destroyed.
- I agree to take part in this research.
- I wish to receive a copy of the report from the research (please tick one): Yes○ No○

Participant's signature:

.....……

Participant's name: .....……

Participant's Contact Details (if appropriate):