FIVE CASE STUDIES EXPLORING THE VALUE OF TECHNOLOGY EDUCATION IN NEW ZEALAND SECONDARY SCHOOLS

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Abstract

There are many factors that influence students in their choice to take vocationally focussed or general technology subjects at secondary school. Equally, there are many factors that contribute to whether or not they succeed in their studies, and what value they place on the different types of knowledge and skills they learn. A student's choices cannot be separated from the social and environmental context in which the student acts. This study presents five case studies that explore the context and experiences of five, very different students of technology who have all recently graduated secondary school. Each case study brings together data from semi-structured interviews conducted with the student participant, one of their parents and their principal technology teacher at secondary school. They provide an insight into how each student perceived their technology education, what influenced them in choosing technology classes, what knowledge and skills they learnt, how that knowledge and skill has served them in their transition into the workforce or tertiary study, and what they perceive are the differences between vocational technology education and general technology education.

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Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

> The number one thing that gets in the way of growth is lack of skills. We still have far too many young people leaving school without the basic literacy and numeracy capability that they need. We've got far too little connection between schools and business, far too little responsiveness in our industry training and not enough support going into apprenticeships (O'Reilly, 2011).

Background and Rationale

O'Reilly (Chief Executive of 'Business NZ') articulates in this statement reporting on a survey of 1000 New Zealand businesses, the problem of how best to educate young people in knowledge and skills that are relevant and useful. Teaching and learning that is relevant to the needs of industry will not only be useful to prospective employers, but also to the students themselves in helping them to successfully transition into employment. However, these statements presuppose that education should be just about preparing young people for specific jobs and not about giving them a broad, general education, opening their horizons and creating critical thinkers that can question societal norms. Educating young people is as complex as society itself. Technology education, because of its historical link with trades training, is perhaps more caught up in the philosophical debate about whether general or vocational training is more valuable to young people than other more traditional academic school subjects.

In 2007 the New Zealand Ministry of Education published a new National Curriculum document giving technology education a broad academic focus. The document outlines eight general achievement objectives for the technology learning area and gives eight level indicator descriptors that track students' progress within the contexts of those achievement objectives. The curriculum document also presents five 'Key Competencies' that teachers in every learning area are required to develop in their students. Since 2010, there has been a review of assessment standards in which vocationally focussed unit standard assessments (apart from the ones that are delivered in schools in partnership with Industry Training Organisations (ITOs)) have been, or are going to be phased out. They are being replaced with a broader suite of achievement standards which are being updated and brought into alignment with the achievement objectives described in the 2007 Curriculum. In 2011 secondary school teachers started teaching these revised standards to their National

Certificate of Educational Achievement (NCEA) Level 1 students (Year 11) and assessing all students to the curriculum's eight level indicators.

There is a risk in the Ministry's vision and drive towards academic general technology that teachers and students who want a solely vocational pathway into trade's apprenticeships will feel marginalised and undervalued. There is already some concern being expressed by secondary school technology teachers that their subject is being directed away from its practical roots and trades training focus (Gawith, O'Sullivan & Grigg, 2007). They fear the demise of workshop based skills and manual competencies and teaching just another academic subject, disconnected from the needs of what they see as the 'real world of work'. Vocational education pathways and secondary school level ITO qualifications have gone some way to allay those fears but the question remains as to why there is an apparent 'disconnect' between schools and industry. The question arises as to whether the disconnection lies in specialist subject specific knowledge and skills or in the more generalised transferable knowledge and skills and as O'Reilly suggests above, with basic literacy and numeracy.

I have taught in secondary school technology departments for twelve years and been the head of a technology department for the last four of those years. I have experienced first hand the evolution of general technology as a curriculum subject, and the reactive rise in popularity of vocational technology education. This research presents an opportunity to explore the knowledge and skills taught in both technology education pathways, and which of those have proved most valuable and relevant in a young person's transition from secondary school to the next stage of their lives. By presenting rich, in depth data through five case studies of recent graduates of New Zealand secondary schools this research seeks to answer the following research questions;

Research Questions

1. What factors influenced these five young people in the choices they made regarding their secondary school technology education?
2. What knowledge and skills were taught in these young peoples' secondary school general and vocational technology education programmes?
3. How do these young people perceive the relevance and usefulness of the knowledge and skills they were taught in their technology education?

Overview of the Study

The research will begin with a literature review that will provide the reader a background into two fundamental philosophical approaches to education that underpin any discussion concerning the merits of either a 'generalist' education or a 'vocational' education. In the literature review, particular attention will be paid to the recent historical development of technology education in the New Zealand, British and Australian contexts. With this background, the literature review will explore issues around parity of esteem between technical and academic subjects, linking this issue to Bourdieu's (1977) thesis of social reproduction through inherited cultural capital. It will then examine more specifically the knowledge and skills taught in both secondary school level vocational technology education programmes and general technology education programmes and how much emphasis is placed on 'practical skills' in each. The review will then explore the terms 'employability' skills and 'key competencies', with respect to education providing students with core, transferable skills and whether these skills are in fact the skills that employers are looking for in their new recruits. The literature review will conclude with a discussion on whether the delivery of these types of skills in both vocational and general technology programmes has seen the two drawing together, or whether they remain distinct from each other with different goals and foci.

After the methodology chapter, the five case study findings will be presented individually. However, the data will be arranged under common thematic headings. This data will then be analysed and discussed in light of commonalities across all the five cases and will be arranged in two sections. The first section will relate to the first research question and the second section to the other two research questions. Conclusions will be drawn from the analysis and discussion and presented in the final chapter along with implications arising from these conclusions.

Chapter 2: Literature Review

Introduction

This chapter presents a review of the literature that informs this study. Particular attention will be paid to exploring the development and differentiations between vocational technology education and general technology education.

Liberal and Instrumental Educational Paradigms

Over the last 30 years there has been a tense and conflicting relationship between two ideologies in the Public Education arena. In a struggle to provide meaningful educational pathways for all students, policy makers have seesawed between the liberalist tradition of encouraging education focused on promoting academic excellence in theoretical knowledge with pathways into university, and instrumentalist education, with the goal of educating students in context-specific vocational skills that will help provide industry with competent, skilled workers. What follows is an exploration of how these educational paradigms have influenced the development, delivery and focus of technology education particularly within the contexts of the British, Australian and New Zealand's education systems.

There is a long standing relationship between Britain and its ex-colonies; now commonwealth countries, such as New Zealand and Australia. Consequently much of New Zealand and Australia's education systems have their foundation in Britain and many of the recent reforms have followed reforms in Britain. Historically both New Zealand and Australia share liberal humanist education systems inherited from Britain during colonial times. With respect to technology education, their early history shares a focus on teaching gender segregated, practical skills focussed curricula designed to provide a trained workforce in the trades and in housekeeping (Williams, 2006; Jones, 2006; Burns, 1997).

Banks (1994) gives a background into the ideologies underpinning educational practise in UK schools. He describes pre 1980 education as 'liberal humanist'; focussed on the development of "intellectual excellence", and "knowledge as being active and interconnected, more than simple recall of facts" (p. 200). He states that this ideology is responsible for the establishment of subject stigmas where intellectual subjects are valued over practical ones. Because of the structure of British national curriculum, many schools are still, according to Banks, "dominated by the idea of subjects as intellectual disciplines…" and

focussed on "…providing a 'general education' within a 'liberal humanist' tradition…divorced from 'the world of work' or any notion of immediate usefulness…" (Banks, 1994, p. 200).

As a contrast to the liberal tradition in education, Banks (1994) describes the 'instrumentalist' ideology as linked closely to vocational and pre-vocational training. Instrumentalism regards education as a utilitarian tool to serve society, improve economic and industrial growth and consequently, the contentment of the populace. The emphasis is on teaching and learning specific, useful, relevant knowledge. Tufnell, Cave and Neale (2002) also suggest governments have taken an instrumentalist approach to education and use it as a utilitarian tool "to meet better the needs of industry and commerce" (Tufnell et al., 2002, p.276). Banks (1994) suggests instrumentalism has been the ideology that has fuelled the political will that has driven the development of Britain's compulsory general technology curriculum.

In the same way as New Zealand and Australia inherited the liberal humanist education system from Britain, their technology education curriculum reforms of the 1990s were directly influenced by the reforms and developments in technology education that occurred in Britain (Jones, 2006; Jones, 2003; Williams, 1996). Jones (2003) describes the 1990s development of New Zealand's general technology curriculum as a response to the country's need for skilled people in science and technology that would, in a very instrumentalist way, help maintain New Zealand's economic standing in the global market place. In an instrumentalist approach the goals of technology education in Australia have been assumed to be "relevant to the economic needs of the nation and to prepare students for work and life in society" (Pavlova, 2006, p.20).

Pavlova's (2006) statement above reflects the focus of instrumentalism as not just meeting the needs of an industrial society and policy maker's desire for national economic growth, but also the economic imperatives motivating an individual to get an enjoyable well paid job. In relation to the individual learner, Banks (1994) describes what counts as instrumentalism as being on a continuum with "training for a specific job" (p. 201) at one end, and at the other, an opinion that appears closer to liberal humanism, and is explicitly expressed in the current NZ Curriculum as a goal for students to "develop a broad technological literacy that will equip them to participate in society as informed citizens and give them access to technology-related careers" (Ministry of Education, 2007, p. 32). The New Zealand Curriculum (2007) appears to have been purposefully left highly

generalised in an attempt to satisfy both liberal and instrumentalist educationists. It specifically states that;

> The learning associated with each [core learning] area [including technology] is part of a broad, general education and lays the foundation for later specialisation…this learning is both end and means: valuable in itself and valuable for the pathways it opens to other learning (Ministry of Education, 2007, p. 16).

On the other end of Banks' (1994) instrumentalism continuum (that is 'training for a specific job'), Britain, New Zealand and Australia have all seen a resurgence of vocational technology education. Whereas by definition, general technology should provide benefit to all students, vocational technology education benefits only those who are pursuing a specific technical vocation (Williams, 2006). Consequently, vocational programmes tend to be 'opt in' and only offered at senior secondary school level. General technology education on the other hand, is part of the compulsory curriculum to junior secondary school level (up to the end of Year 10).

Banks (1994) describes how the Technical and Vocational Education Initiative (TVEI) introduced in Britain in 1983, addressed concerns stemming from the liberal humanist tradition from an instrumentalist standpoint. These concerns were based around the lack of relevance of the curriculum in meeting the needs of society, industry, the nation's economy, and the pupils themselves. The TVEI helped fund and develop programmes with a more vocational thrust, which led to the development of certificate and diploma courses accredited by the tertiary provider 'City and Guilds of London', and suggestions of further links with industry in order to shape what is done in schools. As a consequence "vocational education… was embraced as a more relevant and worthwhile curriculum for those pupils who had not found the values of an academic curriculum meaningful" (Banks, 1994, p.204).

In New Zealand at senior secondary school level, the long standing, liberalist, norm referenced national examination system was phased out from 2001 and replaced by competency based 'achievement standards' and more vocationally focussed 'unit standards', all registered under the New Zealand National Qualifications Framework (NQF). Achievement in both types of standards allowed students to collect credits towards gaining their National Certificate of Educational Achievement (NCEA) level 1-3, for each of the final three years of their schooling. Depending on what courses their school offers, students can

continue with technology as a general academic subject and be assessed under the achievement standards framework, or they can opt to do more pre-vocational, National Certificate, unit standard courses. Secondary schools were automatically accredited to deliver the National Certificate courses in subjects such as computing, sport and recreation, graphics and design. Other National Certificate courses such as carpentry, engineering, electronics technology, and furniture making, require the school to form links with the relevant Industry Training Organisations (ITOs), who then provide quality assurance, pre-moderated assessment material and ongoing support. Vlaadingerbroek (2005) points out that with the restructuring and liberalisation of the NQF between 2002 and 2004, schools have had greater flexibility within their course structure to provide courses of study that cater more to the individual needs of their students. This flexibility and the availability of such a variety of vocational courses, has been of demonstrable benefit to students who may have found traditional secondary schooling unsuited to their learning style or needs (such as Maori, Pasifika, and adolescent boys in general) (Vlaadingerbroek, 2005). Vlaadingerbroek (2005) concludes that;

> With the advent of the NQF, vocationally-orientated education need no longer be a marginal activity in New Zealand secondary schools. Students can simultaneously gain credit towards the NCEA and towards a vocational National Certificate (p. 420).

Similarly in Australia, the vocational education and training (VET) programmes introduced from 1996 for students in their last two years of secondary school, allowed for dual accreditation and credit transfer between vocational qualifications and the generalist senior school certificate (Polesel, 2010; Woods, 2008; Karmel, 2007). VET programmes can be taught in secondary schools that have gone through an accreditation process verifying they have the staff and facilities to deliver them to an appropriate level. Otherwise schools organise delivery by an external registered training organisation.

Pavlova (2006) proposes a useful way forward for international research in technology education would be a comparison between the two ideological beliefs that underpin liberal and instrumental educational paradigms; the liberalist belief that “education is designed to broaden minds and develop all students in the creation of a better society,” and the instrumentalist belief that education is “about training students to live and work in a market-orientated state, to be ‘productive’ in seizing the opportunities of the market” (p.25). In terms of this challenge, Pavlova’s (2006) first statement describing a liberalist ideological belief fits more

comfortably with general technology education, whereas vocational technology education resonates more immediately with her description of the instrumentalist ideological belief. The differences between these two types of technology education, how they have developed, the types of knowledge and skills that are taught in each, and how they serve students in their transition between school and the workplace will be the foci of this research.

Social and Academic Inequalities

What has complicated the struggle between instrumentalism and liberalist paradigms of education, particularly in the context of the broader conceptualisation of technology education (that includes both general and vocational), is the issue of parity of esteem between technical and academic subjects.

Vocational education has had along history of stigmatisation as being of lower value than 'academic subjects' and serving as a 'dumping ground' for children of lower academic ability, and, more often than not, lower socio-economic status (Polesel, 2008; Vlaardingerbroek & El-Masri, 2008; Dalley-Trim, Alloway & Walker, 2008; Teese & Polesel, 2003;Eggleston, 1994). Stevenson (2005) summarises a general attitude towards technical vocational education in this statement; "the vocational is at the bottom of a hierarchy of knowledge and value, it is a stream of learning available to the 'lower achiever'" (pp. 335-336).

One of the original aims of the academic general technology curriculum is to address this traditional stigma attached to technical vocational subjects taught in former craft areas of the curriculum (Polesel, 2010; Jones, 2003; Banks, 1994). Eggleston (1994) states that technology education in Britain's national curriculum marked an attempt to gain a parity of esteem and override old subject prejudices by bringing "technological education from higher education into schools" (p. 25). There is also the hope that general technology will prepare students for the fast pace of technological change and equally fast pace of the changes in the labour market and the type of jobs that will be available to school leavers in the future (Pavlova, 2009). Both initial entry into the labour market and opportunities for promotion once a person has employment are demanding greater and more prestigious academic qualifications (Lehmann, 2005; Teese & Polesel, 2003). General technology education, with its pathway into university study, has the potential to provide more practically minded students opportunities for academic success they may not have had previously. There are however, many valid reasons why an individual chooses not to go to university and the middle-class

assumption that everyone needs a degree to 'get on in life' in many cases is untrue and unrealistic. In fact, the faith that the middle classes have in education as a means to attain social advancement is unfounded, with the more likely outcome being the reproduction of existing social structure (Bourdieu & Passeron,1990).

Bourdieu (1977) develops and describes the notions of 'cultural capital' and 'habitus' which he defines as a system of dispositions inherited from home and continued in school education that results in a self perpetuating system of cultural and social reproduction. Taylor (2008) builds on Bourdieu's work and describes students as forming a 'vocational habitus' as to the type of vocation they will aspire, and naturally gravitate to as they transition from secondary school into tertiary training and employment. Habitus is firstly developed through an individual's upbringing, their family background and what their parents value. This in turn influences the shaping of their aspirations, the expectations they have of their schooling and the subject choices they make.

According to sociocultural theory, education and learning takes place "within interrelated historical, cultural, institutional, and communicative processes" (Lim & Renshaw, 2001, p. 13). Lim and Renshaw (2001) describe sociocultural theory reframing learning to be less about transmission of knowledge and more to do with the learner becoming an active and acculturated participant in communities of practice. To achieve this, according to sociocultural theory, lessons should "include the learner's perspective by focussing on sociocultural knowledge as part of the content" (Lim & Renshaw, 2001, p. 14).

Dalley-Trim et al. (2008) describe a 2002 Australian Council of Education study that profiles Australian students of vocational education programmes as low achievers, from English speaking backgrounds, residing in rural areas, attending Government schools and having parents who do not have tertiary education (Dalley-Trim et al., 2008, p.56). This tends to suggest that different profile students will opt to choose *between* vocational and general technology rather than choose to study both. Once again this differentiation leads to the negative stigmatisation of the vocational pathway (Dalley-Trim et al., 2008; Yeomans, 2002) and the replication of socio-economic structures within society.

Between 2002 and 2004 New Zealand replaced its norm-referenced externally assessed examination system with competency based qualifications and a vast suite of assessment standards. Schools have had the freedom to offer their students a wider variety of both vocational and general programmes, using a

range of assessments that suit both academic and practically minded students. Vlaardingerbroek (2005) describes the vocational National Certificate Qualifications delivered in New Zealand secondary schools in partnership with ITOs as providing opportunities and demonstrable benefits to students who are not academically inclined and may otherwise have ended up leaving school with little or no formal qualification. As Teese and Polesel (2003) point out "it is students with good results who get jobs, while low achievers, though the first to seek work, are often the last to find it." (p. 9). Having school based vocational programmes that count towards crediting students with NCEA qualifications does provide some refuge from the demands of academic success for students who are not engaged by mainstream schooling. However, these school based trades qualifications do not have the same institutional academic credibility as the general technology curriculum because they cannot be used to gain credit toward university entrance.

Teese and Polesel (2003) argue that it is vocational education in schools that has the potential to help democratise access to the curriculum by providing industry endorsed, relevant knowledge and skills that are more inclusive and motivating for those powerless, disadvantaged and disaffected students within society. Similarly Kelly and Price (2009) propose that vocational education in secondary schools "...provides disengaged students with an educational *clean slate"* (p. 810). They identify five key elements present in vocational education: student's choice to take part rather than compulsion, a career focus, experiential learning, multidimensional performance criteria, and teacher-student mentoring relationships. They hypothesise that these five elements may "...offer a positive schooling experience to students who would otherwise struggle in the social comparative and competitive environment of traditional academic classrooms" (Kelly & Price, 2009, p. 819).

Teese and Polesel (2003) argue that if access to the curriculum is going to be opened up to students in a socially egalitarian way, then vocational education needs to be integrated within mainstream schooling and not treated as an adjunct or alternative to the mainstream.

Young (2010a), in contrast, argues that having more of a vocational approach to curriculum design using sociocultural theory, where curriculum content draws from the life contexts and everyday experiences of students, actually leads to these disaffected learners remaining fixed in their life experiences and unable to move beyond their social status. Consequently, even if the 'democratisation' of the curriculum is achieved on some level and more students are able to achieve

some form of academic success in terms of school qualifications, the power relationships within society and social inequalities in education will remain unchanged. Young (2010b) explains there is a danger in blurring the distinction between curriculum: “The knowledge that a country agrees is important for all students to have access to,” and pedagogy: “The activities of teachers in motivating students and helping them to engage with the curriculum and make it meaningful” (p. 23). If curriculum designers and teachers want to address social and economic issues and motivate disaffected learners they need to use those learners’ everyday concepts and experiences as a pedagogical tool rather than curriculum content. In this way they can provide a meaningful context in which to first engage and then teach them theoretical concepts of the curriculum and maximise their intellectual development. Lehmann (2005), in discussing Canadian school based apprenticeship programmes, describes the same conflict where proponents of the vocational scheme feel that it increases educational choice for students and critics feel that the programme is reproductive of social structures.

There are two inter-related issues here; the first is academic inequality and the second, social inequality. Academic inequality sees vocational education as less valued because of its perceived primary focus on teaching specific job related skills rather than transferable theoretical concepts. Using vocational education as a way to engage disaffected learners is seen as reproducing societal structures and social inequality because students are not challenged to move beyond their own experience. The Education System and Curriculum have been perceived as forming a hierarchical structure that favours the few and perpetuates social inequalities (Teese & Polesel, 2003). However, not all students want, or are suited to academic tertiary study but in an egalitarian society, they are entitled to equal opportunity in education. Education should address the needs, abilities and aspirations of all learners rather than just favouring a privileged few. The vocationalisation of education in the sense of providing students more contextualised learning experiences, may go some way towards addressing this inequality. On top of which, all students can benefit from teachers using practical contexts and vocational learning experiences to allow students to make sense of their learning and integrate it meaningfully into their lives (Stevenson, 2005).

General Technology Education and the Loss of Practical Skills

As discussed above one of the original aims of the general technology curriculum was to address the issues of academic inequality suffered by former craft areas

of the curriculum. Jones (2003) describes the NZ technology curriculum revision of the 1990s as including a range of different foci that would presumably satisfy both liberal humanist and instrumentalist educators and help give technology a parity of esteem with other academic subjects, these being;

- academic, with developing technological knowledge and understanding;
- technical, with skills development, techniques and resources;
- intellectual, by encouraging problem solving, metacognition and the development of creative solutions;
- social, with concepts including social concerns and critical consumerism;
- personal, by being student centred allowing emphasis on individual values and culture (Jones, 2003)

General technology education implies a view of knowledge as active and interconnected involving an intellectual process to solve design problems across a range of contexts (Banks, 1994). Consequently, it is more acceptable to the liberal tradition than purely 'craft' subjects, and may avoid similar stigmatisation.

Pavlova (2009) describes general technology education in both Britain and Australia requiring students to be taught more general skills. Thus both technology education curricula are more process focussed and consequently "associated more with the use of knowledge, but do not contain knowledge" (Pavlova, 2009, p. 19). In NZ the general technology education curriculum has a similar process focus. Gawith et al. (2007) describe NZ technology education as swinging away from a practical skills based paradigm towards the training of technologists involved in innovative design and problem-solving in a "critical social context" (p.109). In shifting the focus of the technology curriculum away from the practical knowledge and skills focus of the 'craft' subjects towards a process and design focus, different issues and concerns have arisen including;

1. Ongoing expectations that general technology education will provide students with similar specific manual competencies that have traditionally been taught in craft areas of the curriculum (e.g. Jones, 2003; Williams, 2006).
2. Students lacking these basic manual competencies are unable to successfully complete technology projects at school e.g. Hendley, 2002; Evans, 1998).

3. Employers are voicing concern over new employee's lack of these basic manual competencies (e.g. NZIER, 2006; Sianez, Fugere & Lennon, 2010).

These issues will be explored in more detail below.

There are still expectations from teachers, students and industry that technology education will provide opportunities for students to gain a degree of competency in using workshop tools and gain confidence in their manual skills ability. Jones (2003) points out that technology education is a new development in terms of the National Curriculum and consequently there is no long standing culture of it in New Zealand schools, or in the minds of parents and teachers. Williams (2006) describes the problematic implementation and establishment of the general technology curriculum in Australia that reflects the NZ situation where because of the revolutionary nature of the new curriculum, schools, teachers and the community have not had the time to adjust their understandings and expectations of practical workshop based subjects.

With the introduction of Britain's general technology curriculum, McCormick, Murphy and Henessey (1994) describe teachers and schools resisting the shift in emphasis to 'process' based learning and remaining focussed on teaching the specific skills involved in their own subject specialism. This had the consequence that the aims and leaning objectives of the new curriculum were lost with teachers remaining unconvinced about the value of the curriculum and students de-motivated and disengaged in technology classes. The curriculum promotes a process orientated technology syllabus. Some schools, students and teachers expect technology classes to teach manual skills representing a "...compliant, rather than conversionary, response..." to the changes in the curriculum that reflects a recognition at the chalk face that "...process without content is unworkable" (Evans, 1998, p. 31). In order for students to be able to work independently, use critical problem solving skills and successfully undertake an innovative design process, they must have the practical capability first. Their fine motor skills, the manipulation of tools and machines, and knowledge of materials and their properties are vital if they are expected to successfully complete a design-and-make process.

Hendley (2002) points to pupils lacking in confidence in working with tools and feeling frustrated when their lack of skills leads to unfinished projects as a reason for their not liking Britain's general technology subject at school. Similarly, Autio and Hansen (2002), in their study of the more practically focussed workshop

based Finnish system of technology education, suggest students' self esteem is "built on practical rather than academic achievement" (p.7). Through this practical focus, learning outcomes will include competencies such as "individual responsibility, initiative, creativity, perseverance, and a positive picture of oneself" (Autio & Hansen, 2002, p.7).

NZIER (2006) report a perception by some construction work employers of an overall decline in basic hand skills, not just of school leavers but throughout the industry. Sianez et al. (2010) report that "employers sometimes find [tertiary] technology and engineering graduates ill-prepared due to their lack of hands-on skills" (p. 299). Without the inclusion of the knowledge and skills needed to successful operate within the practical contexts of technology practice, students are being set up for failure, nor are they being prepared in a holistic sense, for life in the world of employment

Teachers come to technology education with different skills and qualifications, their teacher training will probably not have given them the detailed specific knowledge and skills involved in the specific technology subject contexts schools may expect them to teach (Evans, 1998). The NZ technology curriculum initially encompassed seven different specialist technological areas in which general technology education could be delivered, including such diverse areas as electronics, biotechnology, hard and soft materials (Ministry of Education, 1995). The demands of such a broad range of specialist knowledge and skills and the implication that technology teachers will be able to competently deliver or guide students to successful outcomes across that broad a range is unrealistic. Many NZ trained technology teachers come from a trade background and are consequently more comfortable with teaching to their expertise in that particular trade context (Bowskill, Williams & Forret, 2011). Gawith et al.'s (2007) study eliciting questionnaire responses from NZ secondary school technology teachers revealed "a significant dissatisfaction with the direction of the technology curriculum and that teachers were concerned about the loss of practical activities and skills" (p.120). This dissatisfaction was present no matter whether the teacher had been teaching from pre or post the introduction of the new technology education curriculum. Thus Gawith et al. (2007) concluded that their study revealed an 'across board' concern over the trend away from a practical skills based focus.

Of course learning practical knowledge and skills, and learning the process of design and product development are not necessarily mutually exclusive. Gawith et al. (2007) describe a way forward for general technology education as a

rebalancing of emphasis to include more practical work as well as doing what they term as the “academic technological social studies” (p.111) required by the curriculum. They advocate a balanced curriculum that swings to accommodate and develop both practical and academic paradigms of technology education (Gawith et al., 2007, p.121).

In the mean time, vocational technology education has experienced a huge rise in popularity at senior secondary school level (e.g., Dalley-Trim et al., 2008; Karmel, 2007; Williams, 2006).This may be in response to the swing away from the practical skills based focus described above. Teachers perceive general technology as not giving students the appropriate knowledge and skills needed for trade vocations and students are put off by the perception that general technology is too academic and difficult (Bowskill et al., 2011). Vocational technology teaches students with a much greater emphasis on the practical knowledge and skills they will need to work at specific trades. To further explore the reasons behind this rise in popularity there follows an exploration into the development of school based vocational technology in British, Australian and New Zealand contexts.

Vocational Technology Education and its Emphasis on Practical Skills

Yeomans (2002) describes how recent developments in vocational education in Britain have had as their rationale, a desire to raise the status of vocational education qualifications without losing the point of providing them as an alternative to offer those students who are not suited or interested in the more academic curriculum. He describes a reform of advanced level qualifications in 2000 that makes it easier for students to mix academic and vocational studies. However, he states that even though the government is committed to a more flexible curriculum framework in senior secondary school, it perceives clearly differentiated academic and vocational pathways. Vocational qualifications, as in Australia, are seen as a way to help tackle truancy issues among disaffected young people, but that this is “hardly likely to raise the status of vocational qualifications” (Yeomans, 2002, p. 51).

Snell and Hart (2007) describe an unprecedented expansion in the Australian Vocational Education and Training (VET) system over the last 20 years that reflects the increase in government funding in this area. They describe that through a process of privatisation and deregulation there has been a corresponding increase in the number of stakeholders and course providers in the VET system, all of whom are eligible to receive government funding and

subsidies. Vocational training and trades based certificates are being offered as a way to keep secondary school students engaged in education longer (Karmel, 2007; Malley, Keating, Robinson & Hawke, 2001). Karmel (2007) suggests two major factors that drove this policy change were, firstly, "the schooling system did not suit everyone" (p. 102), and secondly, a youth unemployment rate of over 25% in the early 1990s. Snell and Hart (2007) also point to high youth unemployment as a major reason for the expansion of VET in Australia.

Karmel (2007) describes how the Australian VET system has, over the last decade, become "industry led rather than educationally driven" which practically meant "curriculum was largely replaced by training packages built around competencies specified by industry" (p. 104). The system allows for a variety of different structural arrangements for training within or outside the school premises, and different subjects for training depending on regional vocational opportunities. However Polesel (2008) critiques the effectiveness of Australian vocational education, describing the divergent goals of delivering effective, high quality, pre-trade, instrumentalist training, and providing a generalist, academically focussed programme for students to obtain national qualifications and entry into tertiary study. He concludes that these competing goals have led to a dilution of vocational programmes offered in Australia at upper secondary school level such that the bulk of them are of poor quality and provide students with neither "specific competencies" that they can use to enter a trade, nor "substantial generic competencies" (Polesel, 2008, p. 628). He calls into question the extent that many schools' programmes can even be viewed as vocational, as most students taking part carry on into university study, with very few going on into apprenticeships or traineeships. Polesel (2008) states that if students do transition straight into the labour market, they are accessing "mainly casual, part-time and low-paid work in the retail sector" (p. 629).

Snell and Hart (2007) also critique the current Australian VET system, pointing to the fact that there is at least a 40% attrition rate in apprenticeships and traineeships. They link the expansion, privatisation and deregulation of VET to a lowering of the quality of training and the high attrition rate. They describe concerns about the quality of training as a narrowing of skills and outline two concerns around this issue. Firstly, employers are seen as having too much say in the contents of the VET qualification curricula and they see little point "for trainees and apprentices to learn skills beyond what is required for their particular job" (p. 506). This has led, according to Snell and Hart (2007), to pressure coming from employers for training institutions to ""tick off" on certain

competencies despite not having any practical on-the-job training in this particular task" (p. 506). The second concern is that not enough off-the-job training is taking place where underpinning knowledge about the on-the-job practical skills are taught to help students develop a breadth of transferable skills. Getting the balance right of on-the-job and off-the-job training has a large influence on the success of a training programme and the engagement of the students and is a "major challenge for employers and training organisations...too much of either presents problems" (Snell & Hart, 2007, p. 505). These concerns are also present in Britain, with Winch and Clarke (2003) describing British government 'modern apprenticeship' scheme as placing too much emphasis on job-specific training and not enough on initial skill formation that would give students transferable skills to prepare them for entry into an occupation. Winch and Clarke (2003) conclude the vocational technology education system in Britain-

> ...recognises the need for initial qualifications, but fails to provide the articulations between economic development, forms of vocational education that integrate theoretical and practical elements, and a well-designed qualification structure (p. 250).

They propose the solution lies in providing-

> ...structures and qualifications that combine theoretical, simulatory and practical elements within a scheme that apportions a proper division of labour between college and workplace. All this needs to be done within a coherent qualification structure that pays due regard to applied theoretical knowledge, the mastery of skills and their application (Winch & Clarke, 2003, p. 250).

In New Zealand secondary schools vocational education is run effectively as a partnership between school and Industry Training Organisations (ITOs). It is the ITOs who liaise with industry to ascertain the skills they require and then write and register assessment standards and teaching guides that teachers can use in schools. Schools then deliver entry level trade National Certificate courses and students can use these qualifications to ease the transition into trade's apprenticeships without needing to complete expensive tertiary training in polytechnics. There is no research available on the efficacy of the NZ system. However, due to it's similarities with the systems in Australia and Britain, it must be assumed that it faces the same issues and problems as the systems of those countries. Getting the balance right between the 'theory' and the 'practical' appears to be the problem facing both general technology education and

vocational technology education. On the vocational side, educators are faced with the issue of engaging non-academic, 'hands-on' students and keeping them involved in education through a practically focussed programme. However, within that programme they must take care to provide students with the best opportunity for successfully transitioning into a high skilled occupational employment, rather than training them in job specific skills that are difficult to transfer and lead to students "drift[ing] from one low-paid, low-skilled job to another" (Winch & Clarke, 2003, p. 250).

Employability Skills and Key Competencies

The more transferable general skills that all employers want of their new employees have been the subject of extensive research (e.g., ISC, 2011; NZIER, 2006; Tufnell et al., 2002; Curtis & McKenzie, 2002;Mayer, 1992). Described by many researchers as 'employability skills', or 'key competencies', these skills have been suggested as a way of linking the dual pathways of general technology education and vocational technology education (Pavlova, 2009; Stevenson, 2003). Setting aside for the moment the job specific knowledge and skills needed to complete certain tasks, this section will explore what is meant by these terms and how general, transferable competencies are incorporated into school curricula.

Tufnell et al. (2002) describe the introduction of core skills of numeracy, communication, IT, teamwork and problem solving, into British curriculum as a way of shifting the focus away from the overly academic to more vocational, giving "breadth and balance" to the curriculum and "furthering skill transfer and flexibility of qualification" (Tufnell et al., 2002, p. 276). Williams (1998) also states the implementation of core competencies in the curriculum "bridges the liberal-vocational divide by making it easier to transfer between the two pathways" (p.11).

In New Zealand five key competency groups have been co-constructed through a process of consultation and submissions by interested stakeholders, and "based on the OECD Defining and Selecting Key Competencies project (DeSeCo) work on what competencies people need for successful life and well functioning society" (Rutherford, 2004, p. 1). Rutherford (2004) outlines the competency model that was developed through this process where "competencies are integrated, holistic and complex: they include the knowledge, skills, attitudes and values needed to meet the demands of a task" (p. 2).

She differentiates between key competencies, that everyone needs to successfully operate in a variety of different life contexts, and specific competencies, that are needed only in specific contexts. People will necessarily use different combinations of both depending on the purpose and context for their use (Rutherford, 2004).

The five key competencies groups that have been developed are described in the NZ Curriculum (Ministry of Education, 2007) as;

1. *Thinking*, using creative, critical, and metacognitive processes to make sense of information, experiences, and ideas.
2. *Using language, symbols, and texts*, i.e. to work with and make meaning of the codes in which knowledge is expressed.
3. *Managing self*, where students are enterprising, resourceful, reliable, and resilient. They establish personal goals, make plans, manage projects, and set high standards.
4. *Relating to others*, where students listen actively, recognise different points of view, negotiate, and share ideas.
5. *Participating and contributing* appropriately as a group member, to make connections with others, and to create opportunities for others in the group.

They all have been embedded into the latest curriculum document for all subject areas to address, including technology education and reflect sociocultural theory where learning is contextualised within the social and cultural values of a community.

> People use these competencies to live, learn, work, and contribute as active members of their communities. More complex than skills, the competencies draw also on knowledge, attitudes, and values in ways that lead to action. They are not separate or stand-alone. They are the key to learning in every learning area. (Ministry of Education, 2007, p. 12)

Winch and Clarke (2003) argue that initial vocational education prior to actual employment, to impart skills, knowledge and judgement is vital to supply a high-skill productive economy with skilled labour. Vocational education should focus on development of adaptable and transferable, occupational skills rather than job or task specific skills. This argument is supported by Baartman and Gravemeijer (2010) who describe the requirement for non-routine cognitive employment and non-routine manual employment as increasing, whereas jobs involving routine

work as disappearing. This indicates employers will need more of their employees to have a high degree of flexibility and creativity rather than a robotic ability to perform routine tasks efficiently. Lim and Renshaw (2001) argue that because of globalisation and the speed at which technology is changing, cultures and society are also changing as rapidly. They suggest sociocultural theory as an alternative pedagogy that creates new knowledge and meanings about cultures as they change, is more suited to support students in the modern environment than more traditional pedagogy that passes on existing knowledge.

Tufnell et al. (2002) outline what they term 'employability skills' elicited from research they conducted gathering views of employers in Britain. The skills that most employers identified as most essential were 'the ability to cooperate' and 'the ability to communicate'. Categorising all the skills, they identify 'practical competencies' as being rated most important above 'cognitive ability' and 'personal qualities and attitudes'. Practical capability, Tufnell et al. (2002) report, is the "common sense to just get on and do the job with the minimum of fuss" (p. 282). This implies valuing an ability to think on the job, apply and transfer knowledge, skills and experience to solve problems as they occur, as well as manual skills, cooperation and communication and a predisposition to 'fit in' to the culture of the workplace.

Winch and Clarke (2003) suggest that; "Properly trained workers are individually more productive, autonomous, committed, capable of varied and complex operations and able to undertake new tasks than untrained ones" (p. 246).

The Mayer report in Australia (Mayer, 1992) lists seven employment related key competencies as; collecting, analysing and organising information; communicating ideas and information; planning and organising activities; working with others and in teams; using mathematical ideas and techniques; solving problems; using technology.

More recently, Australia's Industry Skills Council's (ISC) (2011) report identifies language, literacy and numeracy (LLN) as the essential skills that underpin people's ability to be productive in their employment, keep learning, developing and participating fully in society. The ISC (2011) report, in describing the challenges to improving Australians' LLN skills, identifies that "there is a difference between school literacy and numeracy and the skills required in the workplace" (p. 5). Students are unable to, or have not been taught to, transfer the knowledge they learn in the classroom to real life contexts. The report describes LLN as being contextual and often inseparable from specific vocational

skills. Even though they emphasise the need to differentiate between "the application of LLN skills to new vocational purposes or settings and the development of the underpinning LLN skills themselves" (p.12), they suggest that in order for meaningful learning to occur, development of LLN skills should occur at the same time as the development of specific vocational skills.

The NZIER (2006) found that for the building and construction industry in New Zealand, foundation skills like literacy and generic skills such as supervision, project management and problem solving, are expected to become more important, but there will also always be a need for traditional craft skills. They point out that in rural areas there is a need for a greater range and depth of skill sets, knowledge and competencies, as there is less opportunity to sub contract in specialists.

It may be concluded that good vocational education should teach students general, transferable 'employability skills' and 'key competencies' within a practical vocational context. Returning to the job specific knowledge and skills required to complete certain tasks, it may be that, as the ISC report (2011) suggests, general competencies and vocational disposition can be taught effectively within the context of specific vocational skills that will engage learners and teach the traditional craft skills still required in many areas of the workforce.

There are many different industries working in many different contexts, with different needs and requirements of their staff. To clarify the role general and vocational technology education plays in meeting those different needs, the next section will critique more closely the research into industry views and the skill sets they require.

The Different Skills Priorities for Different Industries

In examining the research into industry views on the skills that are required of new employees, care needs to be taken to differentiate data and opinion collected from employers who are taking school leavers on as apprentices to trades and those that are taking on higher level graduates. Some employers expect a new staff member to be 'up and running' in the job straight away, while others will train them in the specifics of their workplace context. Companies that employ tertiary trained graduates with the intention of training them in their particular industrial context may be involved in more specific industrial design and manufacture and have the workplace culture that places more value on such factors that Mayer (1992) describes as "creativity, initiative, being entrepreneurial

and being able to think critically about how to improve work practices" (p. 3). This may influence whether the employer considers vocationally educated graduates or general technology educated graduates.

Tufnell et al.(2002) report that when small businesses employ new staff, they need someone who can be productive straight away, whereas larger businesses are more likely to take responsibility for training their new employees. This affect is more pronounced depending on the economic environment industry is working in. In times of economic growth employers are more likely to take on new people and invest in their training. In times of recession there is a greater imperative for employers to want already skilled employees that will make a positive productive contribution to their business without the need for investment in their training (Masdonati, Lamamra & Jordan, 2010).

Yeomans (2002) raises questions about whether the general technology curriculum in Britain, in projecting an image of the solo, inspirational, generic design technologist, actually reflects the reality of real world industry needs, and whether it matters if general technology education is about delivering a broad, liberal education rather than preparation for a specific job.

The New Zealand Building and Construction Industry Training Organisation (BCITO) predicted in a 2006 report (NZIER, 2006) that because the NZ economy was showing signs of recovery from a recession, employers would not be able to count on finding skilled people to meet both their replacement and growth needs. They suggested large numbers of new workers would be needed over the next few years and that the training of these new workers needed to start straightaway, if they were going to be ready in time to meet the increase in demand. The report outlined a problem employers faced with their carpentry apprentices being poached or leaving to seek better remuneration overseas. Consequently the employer missed out on the return on their investment in training the apprentice. Winch and Clarke (2003) similarly describe a low skill approach where employers train their workers in very specific non-transferable skills so as not to lose them to better paying jobs elsewhere.

> The dominant strategy of an employer where there is not a strong skill-driven occupational labour market is not to train. Training one's employees poses the risk that they will be employed by someone else who has not incurred the training costs (thus enabling them to offer more favourable terms of employment), while not training allows an employer to

> adopt the converse strategy vis-à-vis other employers who do train (Winch & Clarke, 2003, p. 249).

Aspirations of students may also influence which pathway they take in their secondary school education; do they intend to go to University or get a job or apprenticeship directly on leaving school. Students opt for subjects that they think might get them a job, or in which they have an interest or particular ability (Hendley, 2002). Employers may also look at a potential employee in terms of their own experience of secondary school, employing someone who has had similar experiences to their own. As a consequence, they may feel that they will be able to relate to and deal with them more easily than someone who has come via a different educational pathway.

On a base level, students and employers both have a range of wishes, aspirations, abilities and interests. Some generic skills and abilities may be commonly valued within society in general as discussed above. However, they are not specific subject skills but more general life skills that are taught across the whole curriculum in every subject. The difficulty secondary school's technology departments face is how best to cater for the variety of students and their aspirations and abilities and produce graduates capable of fulfilling the wishes and needs of an equally varied group of employers. Whether or not it is necessary or even realistic for all schools to achieve this goal is a mute point. Further, this returns to the question of what role or function society wants schools to fulfil. Are they a place to raise the next generation of free-thinkers able to act with critical integrity in our complex, ever changing society? Or are they a place to pre-train workers for the job market and help grow the economy? These questions are beyond the scope of this study to answer fully but need nevertheless to be addressed for schools and the education system as a whole to function cohesively and benefit both the individual students and society.

The Conjunction or Separation of General and Vocational Technology Education

The development of generalist technology education curricula has led to a shift of emphasis away from manual skills and teacher focussed learning to a broader more generalist conception of technology education that strives to be gender inclusive and allow for student centred, flexible learning outcomes (Williams, 2006).

In the context of the implementation of British general technology curriculum, Smithers and Robinson (1994) argue that there is confusion as to what general technology as a subject actually involves. They suggest a reason for this confusion is that the terms 'technology' and 'vocational education' have been used interchangeably. They propose a solution would be to treat 'technology education', what they call 'basic life skills' such as cooking and using computers, and 'vocational education', as separate entities, rather than struggle to incorporate everything into the one overarching subject. That way students would be able to gain 'basic life skills' or start learning a trade without it "becoming intellectualised and part of some grand theory" (Smithers & Robinson, 1994, p. 38) and 'technology' can be run in schools within its original vision and intention without confusion.

Over the last twenty years Britain, New Zealand and Australia have all developed vocational technology education pathways as distinct from academic general education and the generalist technology education of their curricula. Williams (1998) argues that this resurgence of vocational technology education actually limits general technology education in that "technology education as general education must go beyond the needs of industry for its goals, to some of the principles of a liberal education that are applicable to technology" (p. 1). In a review of the last twenty years of technology education in Australia, Williams (2006) describes the implementation and establishment of the general technology curriculum as 'problematic'. He believes the introduction of the school based vocational technology education programmes has exacerbated the problems, suggesting that some secondary school teachers have used "the introduction of industry-accredited vocational courses as justification for the maintenance of traditional vocationally orientated methodology and content in the compulsory years" (Williams, 2006, p.185).

It can be argued that the existence of similar industry-accredited vocational qualifications in NZ have led to similar attitudes in NZ secondary school technology teachers (Harwood & Compton, 2007; Jones, Harlow & Cowie, 2004). Looking at the most recent developments in NZ technology education the Ministry of Education has provided guidance and support to teachers in terms of specifying the context specific specialist knowledge and skills students should know at senior secondary school level within general technology education (Te Kete Ipurangi, 2011), but not at the compulsory junior secondary school level.

The 2007 NZ Curriculum presents what the Ministry of Education perceives as "the generic aspects of Technology Education… the concepts and practices

common across all learning contexts in technology" (Ministry of Education, 2009a, p.1). There is a recognition in the draft papers for the standards alignment, that, "in the senior secondary school, technology is taught as subjects within the Technology Learning Area" (Ministry of Education, 2009b, p. 1). Those subjects are named specifically as; hard and soft materials, electronics and control, biotechnology, food technology, ICT and digital technology, and graphics. It is recognised that these subjects have context specific knowledge and skills for which in 2009 the Ministry of Education commissioned expert panels to write 'bodies of knowledge' that students would be expected to learn at this level of study. From these 'bodies of knowledge,' subject specific teaching and learning guides for the optional senior secondary level general technology programmes were developed. Assessment standards that assess the generic components of technology education must overarch all the subjects of technology and "cannot be subject endorsed as they assess the same competency [no matter what technology subject a student is working in]" (Ministry of Education, 2009b, p. 3). Consequently the 2011 technology assessment matrix has been designed with consideration given to providing assessment standards that will assess both generic strand components and subject specific knowledge and skills that will, in the ministry's words "reinforce the status of the subjects of technology under the learning area of Technology" (Ministry of Education, 2009b, p. 3). However there is nothing published that outlines these subject specific knowledge and skills at junior levels of schooling. It has been left to the individual teachers to design their own junior programmes to teach whatever skills they think might be needed for their students to achieve later in senior secondary school.

Vocational technology education, in teaching skills and competencies involved in specific trades, necessitates teacher driven learning where the teacher is the expert and imparts his/her knowledge to the student (Bjurulf, 2010). General technology education, on the other hand, is student driven. The student is the investigator, researcher, designer and problem solver, while the teacher is available for guidance and support if needed (Jones et al., 2004; Williams, 2006). At first glance these two approaches to teaching and learning seem quite distinct and separate from each other. However both have a point of commonality which is that the learning is contextualised to real life situations. Stevenson (2005) argues that having a vocational context to learning is central in providing the opportunity for individuals to "make meaning by engaging in significant activity" (p.335). How a person understands or 'makes meaning' from a situation they encounter in work or everyday life enables them to act or react appropriately, and is bound completely in the context of the situation. It is easier to learn by doing

something significant and meaningful than it is to learn by applying decontextualised theoretical general knowledge to new situations.

> Vocational education experiences should involve learners in making connections with other ways of making learning (e.g. theoretical and academic ways) and vice versa. Neither way of making meaning should be seen as inherently superior or worthy of more value, but the vocational should be seen as central because of its role in affording significance, and therefore access to making new meaning (Stevenson, 2005, p.351).

Stevenson (2003) explores the dichotomies that differentiate how general technology education and vocational education are perceived. With close examination in the context of changes in the work place and labour market, Stevenson (2003) argues the differentiations are not as profound as first envisaged. He predicts that, as vocational education evolves to meet the needs of an industry that "can no longer rely on the predictable tools, equipment, materials, processes and skills that characterised the relatively static jobs of the past," (p. 202) the distinction between it and general technology education will diminish further. Lehmann (2005) describes the skills required in the workplace changing with the development of new technologies and different organisational structures to now "emphasize individuality, problem-solving skills, and other skills more traditionally associated with academic careers and promote the idea that all workers need to be knowledge workers" (p. 332). Williams (1998) also notes that the line between vocational and general technology education is becoming more and more blurred.

Pavlova (2009) analyses and explores the similarities between general technology and vocational technology in terms of their ability to develop students' generic competencies and capabilities. She suggests improving the vocational relevance of secondary schooling, and including key competencies and life-based learning could see a convergence between vocational and general technology education based on individual development. Rather than general technology education and vocational technology education being in opposition to each other, Pavlova (2009) proposes technology education could be-

> ...an effective means to develop personal qualities and the generic skills required to achieve better employment outcomes. It provides an essential component in support of the vocationalisation of secondary schooling by relating curriculum to "real life" in an effective manner (p. 11).

Stevenson (2003) suggests general technology education, with its focus on individual design innovation and problem solving, and developing knowledge that has a broader application than specific jobs, is more suited to the real demands of industry than vocational education. He suggests the danger for general technology education is a pedagogical one and recommends ensuring learning is grounded in meaningful practice and not completely de-emphasising specific, concrete, functional knowledge like the skills needed to work with tools and machines traditionally taught in vocational programmes.

Conjunction of Vocational and General Technology Education in New Zealand

With the implementation of the 2007 NZ Curriculum and the review and alignment of assessment standards with that curriculum, it could be argued that we are seeing a shift in focus away from the dual pathways of technology education and a move towards a conjunction of the vocational and the general. Even some ITOs have taken the proactive step to write their new unit standards so that they more closely reflect the intent of the new curriculum. The Electrotechnology ITO for instance, has recently registered some Level 3 standards with NZQA that test a student's ability to work independently, to manage the process of designing and making an innovative electronic product. The new standards are also the first unit standards to have a graded assessment structure that aligns with the 'achieved, merit, excellence' structure of achievement standards. This means there is outwardly no difference between them. Functionally for teachers though, the new unit standards are still clearer than achievement standards in the performance criteria they prescribe the student must achieve to gain competency.

Another example of the move towards conjunction of vocational and general technology education in New Zealand is in the focus and assessment criteria of national competitions ITOs hold annually for secondary school students. The competitors are not just judged on their technical skills in completing their entry, but they are also judged on evidence of the process they followed. The BCITO has its 'Build-ability' competition for carpentry students, focussing on a team build of a project for the local community. ETITO has the 'Brightsparks' competition focussing on creating an innovative electronics product or software to meet an identified need or opportunity in the market place. Competenz, through Tools4Work, has an engineering competition in which students individually or as small teams, design and build ride on mini motorbikes that they race against each other and bikes from other schools. The Hospitality Standards Institute (HSI) has a 'Great New Zealand Vegetable Dish' competition for senior secondary school

hospitality students, where this year they were asked to create an innovative recipe showcasing cauliflower as the main ingredient. All the competitions encourage students to develop creative, problem solving skills, and use their technical subject specific knowledge and skills to create an innovative design solution. All but the HSI competition allows students to work cooperatively in teams, with the BCITO competition actually requiring a team effort.

The existence of these competitions illustrates the trend towards an institutional confluence of vocational and general technology education and contextualised project based learning. However in terms of structural replication of social inequality, individual's access to the competitions requires schools and/or students to invest financially in competition entries. It requires teachers to be motivated and able to mentor students to produce suitable entries, or students having support from home. When one looks at the finalists of the competitions, there is a predominance of students from higher socio-economic decile schools that reflects the same predominance of success in the more traditional academic educational pathways.

Sociocultural theory proposes that education is about helping young people to grow and giving them the knowledge and skills to function effectively and positively in society (Lim & Renshaw, 2001). The relative value placed on different knowledge and skills by society necessarily has an impact on what is taught and the way it is taught in schools. Political ideology must also play a part in determining the type of a nation's education system, its goals and values. However, the test of the success of any education system is to look at the young people graduating from that system; whether they are able to function effectively and positively in society and lead fulfilling lives that make best use of their abilities and potential. Technology education is a relatively new development in many countries' national curricula and consequently, may prepare students for the modern world in more effective, contemporary ways. This research aims to provide some insight into these issues and in the next chapter the methodology of the research will be described to give a picture of how the research has been designed to address this aim.

Chapter 3: Methodology

Introduction

This chapter presents the design and methodology used in this study. It describes the rationale behind the choice of research participants and how the research data was collected and analysed with reference to the validity and reliability of the data itself, and any ethical issues faced

Research Design

Under the National Qualifications Framework New Zealand secondary schools have had a valuable opportunity to provide students a range of different programmes and assessments tailored to suit their needs and abilities, and provide them with pathways into employment that are useful and meaningful. This study proposes to investigate how the existence of the dual pathways of vocational technology education and general technology education have served students in meeting their needs and aspirations and how the skills and knowledge taught in each, have helped transition students into the workforce or tertiary study.

There are many factors that influence a student's choice to take technology subjects at secondary school, and equally many factors that contribute to that student succeeding or not in their studies. A student's behaviour cannot be separated from the social and environmental context in which the student acts. To understand the behaviour it is necessary to understand the context in which the behaviour occurs, "It has to be studied in total rather than in fragments if a true understanding is to be reached" (Cohen, Manion & Morrison, 2007, p. 167). It is generally accepted that influences from factors such as ethnicity, parental occupations and socio-economic status have a significant impact on young peoples' transition into tertiary study and/or straight into the workforce (Evans, 2002). Evans (2002) states that researchers have recognised that "...the influence of social structures [on young people] was not direct, nor was it deterministic" (p. 246).

There are indications that young people are increasingly making their own pragmatic choices and decisions as a reaction or response to structural influences and to realise their own aspirations (Wyn & Dwyer, 1999; Rudd & Evans, 1998).

In order to gain a more holistic picture of the complex interplay between structural influences and students' own agentic decision making, this research will use a 'naturalistic' case study approach, to collect rich, detailed research data. The research has been conducted using qualitative, interpretive methodology. In the socially constructed meta-paradigm, knowledge is seen as a human construct, inseparable from the knower. The researcher, in order to understand an individual's behaviour, point of view and interpretation of the world around them, needs to share that person's frame of reference. As Cohen et al. (2007) suggest, they need to "come from the inside, not the outside… social science (in this paradigm) is thus seen as a subjective rather than an objective undertaking" (p.19).

The aim in conducting these case studies is to find out what it is that influenced the young participants to choose between, and achieve in, both vocationally focussed industry training technology programmes and general technology programmes. In doing this I hope to highlight the relative value of both.

Participants and context

It is difficult to make generalisations from case studies where there is a "great deal of variability in the population from which the case was selected" (Shaughnessy, Zechmeister & Zechmeister, 2006, p. 337). However, collecting 'thick', detailed descriptions of the characteristics, situations and contexts of a limited sample of student participants, and being explicit in describing the analytic categories this research uses, will, as Goetz and LeCompte (1984) suggest, allow meaningful comparison to be made to other students studying technology subjects in New Zealand secondary schools. To best allow for "comparability" and "translatability" (Goetz & LeCompte, 1984, pp. 8-9), care needs to be taken in the selection of participants for these case studies. This research will look at sampling "critical cases: in order to allow maximum applicability to others" (Cohen et al., 2007, p. 176).

The participants in this study were five young people from three schools of different environmental contexts, with the aim of providing five broadly different stories. One of the schools is a small, low decile, provincial secondary school, another a larger high decile provincial school and the third is a large mid decile urban school. Rather than study five students from five different schools it was thought valuable to study three students (Emma, Hemi and Lorenzo) from differing ethnic and socio-economic backgrounds who were exposed to the same opportunities at the same school, to gain some insight into the role and impact

family background had on the choices these particular students made in their technology education.

The research intends to examine the range of pathways and programmes that technology departments have been able to offer and the value inherent in that ability, by studying students who have been through those different pathways. Consequently, one student (Emma) has been through the general technology graphics programme, one (Darcana) the general technology materials programme, and three more (Lorenzo, Hemi and Chester) through a range of different vocational programmes. The different schools, their technology programmes at the time the student participant attended the school, and which programmes each student participant undertook are presented in the following tables. Table 2 presents the general technology programmes offered in each school and Table 3 the vocational programmes.

It is useful to remember that general technology programmes are a compulsory component of the NZ Curriculum until the end of Year 10. However, two of the schools prepare their students for the vocational programmes they deliver at senior secondary level by combining vocational style content in their junior general technology programmes.

Although the students took a range of different technology programmes and the three schools cover a range of socio-economic deciles, all the students come from families with more a vocational rather than academic or professional background. This was not an intentional outcome at the outset of the research project but may be an illustration of the continued preference of academically able students to take the traditional academic subjects rather than programmes offered under the umbrella of 'technology education'.

Table 1. *Colour key for Tables 2 and 3.*

	Small, low socio-economic decile, provincial school
	Large, high decile provincial school
	Large, mid-decile urban school

Table 2. *Programmes Based on General Technology Achievement Objectives in NZC.*

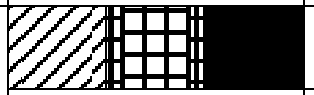
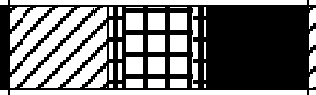
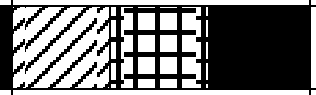
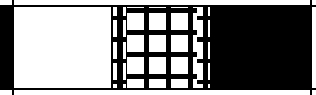
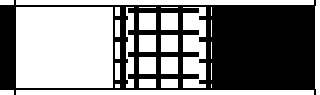
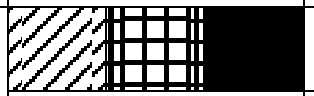
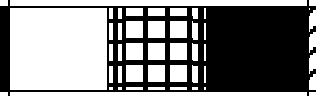
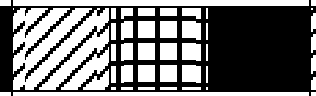
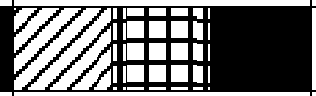
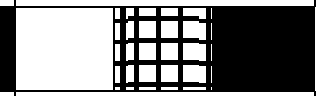
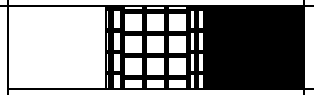
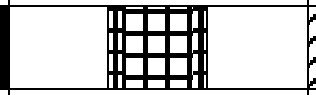
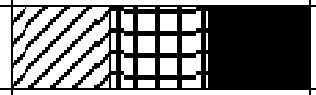
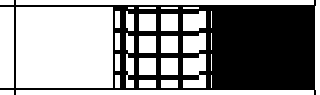
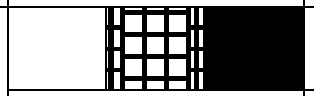
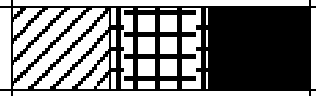
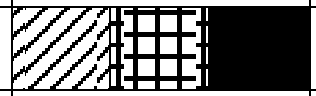
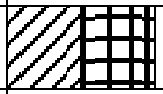
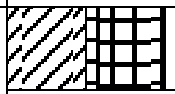
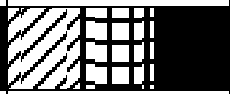
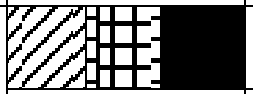
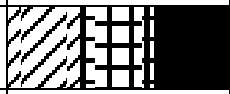
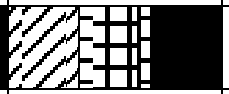
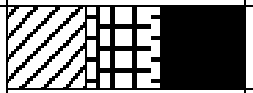
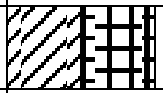
	Hard Materials	Soft Materials	Food	Graphics	Electronics	ICT
Year 9						
	Darcana Hemi Emma Chester Lorenzo		Hemi Emma Chester Lorenzo	Hemi Emma Chester Lorenzo	Darcana Chester	Chester
Year 10						
	Hemi Darcana Chester Lorenzo			Lorenzo	Darcana Hemi Emma Chester Lorenzo	Chester
Year 11						
	Darcana			Lorenzo Emma		
Year 12						
	Darcana			Emma		
Year 13						
	Darcana			Emma		

Table 3. *Programmes Based on ITO Vocational Training Objectives.*

	Building and Construction	Furniture	Engineering	Hospitality	Fabrics	Electronics	Automotive	ICT/CAD
Year 9								
				Hemi Emma Lorenzo				
Year 10								
	Lorenzo Hemi		Hemi					
Year 11								
	Lorenzo Hemi	Chester	Hemi					
Year 12								
	Lorenzo Hemi		Hemi Chester			Darcana	Chester	Hemi
Year 13								
	Lorenzo Hemi		Hemi Chester			Darcana		Emma Lorenzo

Both a student's family and their teachers play an important role in influencing young people in the life decisions they make and the system of dispositions they form towards following different educational pathways (Bourdieu, 1977). In acknowledgement of this, the students' parents and main technology teacher were also interviewed in order to gain a more complete picture of the circumstances and background of each student.

Data Gathering Method

The data collection has focussed on obtaining qualitative, rich data about the respondents' opinions and motivations. Data was gathered through interviewing the student participants in semi-structured interviews, about their experience of secondary school technology classes, their teachers, their school's course structure, and the influence of their family. Semi-structured interview protocol was chosen over more structured interviews because there was a general idea of the type of knowledge and experience required from the participants but freedom was also needed within the interview structure to allow the participants to generate rich, detailed, in depth data. As Lincoln and Guba (1985) describe;

> The structured interview is useful when researchers are aware of what they do not know and therefore are in a position to frame questions that will supply the knowledge required, whereas the unstructured interview is useful when researchers are not aware of what they do not know, and therefore, rely on the respondents to tell them! (p. 269).

The interviewer used a list of questions (see appendix 2) as Terry (2003) suggests, "as catalysts for conversation, rather than prescriptive lists to follow in the same order, and in the same words, for every respondent" (p. 26), in order that the respondent can feel more at ease and answer more fully. The interviews were started with easy to answer, closed questions and worked up to a pattern of conversation that had the interviewee reflecting more extensively and answering more deeply. In Bishop's (1997) words, conducting the interviews as semi-structured, in depth conversations provided "the opportunity to develop a reciprocal, dialogic relationship based on mutual trust, openness and engagement, in which self-disclosure, personal investment and equality is promoted" (pp. 32-33).

The interviewees were given the option of choosing where they wanted the interviews to be conducted to allow them the opportunity to choose a place that

they would be most comfortable in and minimise any inconvenience to them. All the teachers chose their school offices as a convenient and private location. Most of the parents chose their own homes and the young people were interviewed in their workplace 'smoko' room whilst it was not being used by other staff, their home, or the researcher's office at university. Hemi and his Mother were the only participants interviewed together and this was done in the researcher's office. Through Maori cultural considerations and the concept of 'whanau support' (Bishop & Berryman, 2006), it was deemed more beneficial to interview them together where they would be more likely to feel comfortable and open to in depth discussion, than if they were interviewed separately. The interviews were digitally recorded and notes were taken during the interviews.

Data Analysis

The raw data was analysed in terms of meaning rather than number. The interviews were listened to by the researcher and partially transcribed identifying particular themes relevant to the objectives of the research. These transcriptions were then supplied to the participants for validation, comment or correction. The transcripts became a useful tool "to help the participants to reflect, modify and reflect again on their ideas in order to present the meaning they sought in a form understandable to the reader" (Bishop, 1997, p. 37). A system of thematic analysis based on a variation of the methodology of Marshall and Rossman (1999) was applied to the raw data through a process of listening and re-listening to the recordings to initially identify the themes and then to extract the thematic data. This was then re-analysed in transcript form and integrated with the researcher's notes to produce the findings which are reported and discussed in the following chapters.

In order to maintain authenticity, the interview data in the findings chapter is presented as much as possible, in the interviewees own words. However, direct quotation marks were used sparingly and some paraphrasing of interviewee responses were made that maintained the integrity of those responses but also allowed the text to flow for the sake of readability.

Validity and Reliability

The researcher, being a head of a secondary school technology department and consequently having a good understanding and background knowledge of the research area, was able to gain credibility with the interviewees. It also allowed

the researcher to have an understanding of the interviewee's responses and ensure the reliability of those responses by cross-checking with his own knowledge and experience. The researcher was able to ask appropriate probe questions to illicit full and in depth responses, enabling meaning to be co-constructed, checked, clarified and validated as the interview progressed.

It can be difficult to elicit more than monosyllabic answers from teenagers in semi-structured interview situations (Bassett, Beagan, Ristovski-Slijepcevic & Chapman, 2008). Bassett et al. (2008) suggest a solution to this problem is to first cultivate a trusting relationship with the teenage interviewee so the interviewer can 'connect' with them in more than just a superficial way. Bassett et al. (2008) describe it being easier for 'cultural insiders' to gain trust and develop a rapport with their interviewees because they share commonalities and understandings of cultural subtleties that 'outsiders' may miss. From the researcher's experience as a classroom teacher, an ability and understanding of that age group was achieved and the researcher was consequently more readily able to 'connect' with the student interviewees. However Bassett et al. (2008) also describe a danger in this shared cultural understanding that needs to be addressed: 'Insider' interviewers tend to finish interviewees sentences without letting them express their thoughts in their own words because they implicitly know what the interviewee wants to say. 'Insider' interviewers may also omit or cut short certain lines of questioning through assumptions based on familiarity and a mutual understanding of what is going to be said. This danger is addressed through having a list of questions as prompts or reminders available to the interviewer during each interview, and going in to the interviews with the mindfulness of letting the interviewees finish the expression of their ideas without interruption.

Shaughnessy et al. (2006) describe another weakness that is inherent in this type of 'self-reporting' data collection in that it may be biased either by the participant or the observer. This is particularly relevant to this research as the validity of the interview data relies on the memory of individuals across the time frame of the four or five years when they were at secondary school. With three of the student research participants there has been an historical teacher/student relationship with the researcher, however none of the students have been in that relationship for some time. Consequently, at the time of interviewing them for this research they had no vested interest in 'trying to please' the interviewer with answering questions with the perceived 'right answer' rather than a completely truthful

answer. To further obviate these dangers the data has been validated through triangulation by obtaining through separate interviews, other accounts of the same experience from the perspective of the participant's teachers (other than the researcher) and caregivers.

Each interviewee was interviewed just once. However, providing the opportunity for the research participants to revise or clarify their responses through going over the partial transcriptions and seeing the thematic categories the researcher made from their interviews has further validated the research data.

Ethics

Ethics approval was formally gained through the Waikato University Centre for Science and Technology Education Research ethics committee.

According to Cohen et al. (2007, p.52), full informed consent involves the participant being competent, having full and comprehensive information about what is involved in the research project, and voluntarily, without force or coercion, giving their consent to participate. All the student participants were aged over eighteen years old so there were no consent issues with having to obtain parental consent for participation. Having all the participants aged above the legal age of consent meant as long as full and comprehensive information about the project was provided they could make an informed decision whether or not to participate. Consequently, all the above requirements for informed consent were satisfied.

Teachers tend to build a trusting relationship with their students over the years that they teach them. There is also a collegial community culture amongst teachers. As a teacher, the researcher has 'insider' status in this community and was able to use this status to gain access to suitable student participants through recommendations and referrals from other teachers. The researcher initially approached prospective respondents through telephoning or e-mailing them and outlining the intentions of the study and what would be involved if they were willing to participate. If they expressed a willingness to take part, informed consent was obtained through sending an introductory letter (appendix 1) and consent declaration (appendix 2) restating what was talked about on the telephone or through e-mail. A copy of the appropriate set of interview questions (appendix 3) was also forwarded to them if requested.

Opportunity was given for their withdrawal from the study up to the point where they had the opportunity to read and respond to the partial transcription of their interviews, the initial thematic analysis and interpretation of those interviews.

The respondent's confidentiality was assured from first contact and in the body of this thesis each respondent is identified by a pseudonym.

Having described the research design and data gathering method the next chapter presents the findings collated from the interviews.

Chapter 4: Findings

Introduction

This chapter presents the collated data gathered from the interviews conducted with the five young people, one each of their parents and their respective, main secondary school technology teachers.

Organisation of the Findings

The data gathered from all the interviews has been collated and arranged into five common thematic sub-headings; background, aspirations and inspiration, abilities and limitations, contextualised learning and knowledge and skills. Each case will be presented individually, with the data presented under those sub-headings.

To briefly introduce each case in the order they are presented here;

1. Chester is currently completing an apprenticeship in diesel mechanical engineering. He went to a high socio-economic decile, provincial school where he took predominantly vocational technology programmes.

2. Hemi is currently enrolled in a tertiary institution taking a course designed to help students gain entry into Police Training College. He went to a low socio-economic, provincial school where he also took predominantly vocational technology programmes.

3. Darcana is currently unemployed. He went to a mid socio-economic decile, urban school where he took general technology programmes along with ITO vocational electronics.

4. Emma is in her first year of an undergraduate University degree studying law and business. She went to the same school as Hemi but took a general technology programme.

5. Lorenzo is currently employed as a home insulation installer. He also went to the same low-socio economic, provincial school as Hemi and Emma. He took vocational education subjects but also did one class of general technology at Year 11.

Chester

Background. Chester was born in Britain and immigrated to New Zealand with his family when he was 13. He consequently did all his primary schooling in Britain and all his secondary schooling in New Zealand. He completed all five years of his secondary schooling at a large provincial, high socio-economic decile, co-educational secondary school. Chester is the elder of two boys and his younger brother, who their father perceives as having a much more cavalier attitude, left school during Year 11 to take up a place on a pre-trade vocational training course at a large motor mechanic dealership. In Britain, both Chester and his brother grew up with their father building off road cars and going to racing trials in the weekends and holidays. Chester is now just finishing his apprenticeship as a tractor and farm machinery mechanic at a firm in the same town as his secondary school.

Chester's father is a mechanic by profession and did his training in Britain. He was born in England but immigrated to Australia with his family when he was nine years old. He found school boring and difficult to be sitting at a desk all day. Chester's mother is also English and trained in Britain as a hairdresser, but did not keep up the profession when they immigrated and now works as a home-help caregiver for the elderly. She and Chester's father separated after Chester had graduated high school. Chester describes both sets of his grandparents as being "all from working class, so they just did high school and then they went and got jobs."

Chester's father sees great changes in the automotive mechanic trade with big city car dealerships not really teaching their apprentices any more than basic servicing, because, he says, that is all they do and specialised jobs are all contracted out to specialists. Chester's father believes that apprentices would struggle to gain all the practical experience they need, and to be taught to do everything properly, he believes could only be achieved in either rural areas or at workshops that specialise in trucks, tractors or heavy machinery. He sees a tendency now for school leavers to be used as cheap labour with the promise of starting them off on an apprenticeship but those formal apprenticeships never eventuating.

Aspirations and inspiration. Chester based his subject choices at school on what he enjoyed or was interested in, rather than what might help him achieve his future employment aspirations. He did not choose to do the design technology class because he felt there was too much classroom based designing and

drawing; “like architects there with big rulers and boards and it didn’t really suit me”.

His father said that about eighteen months before he graduated school Chester wanted to go to university to become a lawyer, but then changed his mind and wanted to go into the Airforce. He then ‘went off’ that idea too, even though his father encouraged him to pursue the Airforce option rather than being a lawyer, because the training is funded, compared with owing thousands on a student loan.

His father tried to influence him in his subject choices at school to help with these aspirations but with little success. He said that Chester never talked a lot about it but just weighed up all the options and then made his own mind.

The experience of Chester‘s teacher is that most of the students who do technology subjects “just want to be a carpenter or a mechanic”. Many students come from rural areas or have parents with trade backgrounds, and so tend to have a practical focus because that’s what they are comfortable with. They are more interested in how rather than why things are done.

Abilities and limitations. Chester perceived himself as more a practical student rather than academic; good with his hands. Chester‘s father didn’t think he’d be a motor mechanic. He tells of being very frustrated with Chester’s endeavours at any sort of mechanical pursuits at home; fixing bike punctures would take ages and then still would not be fixed properly and later whilst he was still at secondary school he pulled an old landrover to pieces to do up. He got two thirds done then left it, it stood for four years in the shed before they sold it. Chester‘s father describes Chester as being “steady, you won’t get [him] to rush no matter what you do...he’s a perfectionist.” He perceived Chester as being reasonably good academically but more in terms of his self motivation, self discipline and his persevering attitude towards his study and doing homework; “he wasn’t up near the top [of the class] but he always put the effort in, he always did the work, and got good results.” Chester‘s father perceived him as being more artistic, good at drawing, he played the trumpet, and he felt he is good with his hands in a creative way rather than a technical way.

Chester had an after school job at a local cabinet making firm for a number of years. He was offered an apprenticeship there when he left school but did not take it up. His father said they were very disappointed at the firm because they

said it was very difficult to get good, motivated and conscientious young people to employ these days. Chester was appreciated for his perseverance, ability to work independently, the accuracy and care he took with practical tasks, and making the effort to do a 'good job'. His father said Chester always asked if he was unsure of how to do something or just wanted to check to make sure how he thought he should do something, was actually right. His father believed that was a skill that he had instilled in Chester at home but also admits that his younger son never learnt it. He puts it down to their two very different personalities.

Contextualised learning. Although he enjoyed maths, Chester had difficulty in seeing the relevance of English; "writing paragraphs and stories and stuff, you don't know why you're doing it". Chester said that once a student decides that they want to go to university then he sees that academic subjects are useful in helping them succeed in that goal. However, for practical kids who know they are not going to go to university, then he does not see the point, saying these students would ask "why am I here doing this". They do not see the relationship with what they want to do and what is being taught in a lot of their subjects.

He found "all the writing and theory and everything" in non-technology subjects "pretty difficult". He felt he always achieved in his classes but did not excel. He felt he may have achieved better in the academic classes if the theory could have been linked to a practical context. "Not having a pen and paper in front of me" made the practical classes more enjoyable. The theory he did in the vocational classes he found easier than the theory of academic classes like science, because the subject matter he was reading about interested him. He points to the example of the horticulture and biotechnology he did in a short Year 10 course as being much more enjoyable because it achieved a nice balance between "a little bit of science, a little bit of theory and a little bit of practical."

Chester found learning the theory in his senior vocational subjects as directly linked to doing the practical tasks in the school workshops. The theory books outlined the 'how to' process; things like the firing order of engines and how to pull an engine down, then the students would go into the workshop to practice and test that knowledge in a real life context. He said having this real context for knowledge was important especially for the 'practical minded' students in his class; "some of the books are real hard to get your head around... then you see it working and you've got it in your hands and that's easy as!" Because of the automotive course at school he felt "you hit the ground running" in his

apprenticeship, because all the skills and concepts are there already in your head.

Chester thinks it is very testing for practical students and students who come from a rural background to be in a classroom all day. He says schools have a hard job trying to cater for everyone but having the practical classes definitely helps.

Knowledge and skills learnt in secondary school technology classes.
Chester perceives the main thing he learnt in junior technology and the most useful to him now in his apprenticeship, is project management (tasks and time); “for me now, being a mechanic, it was more like programming your head about how to go through things and do stuff.” In doing all the different things in the junior technology rotations he felt that they all were teaching the process of how to get things done. Whether the subject matter of the course interested him or not, he felt doing the technology programme was beneficial for gaining what he termed as this ‘basic life skill’.

Chester’s teacher describes how the junior technology programme when Chester was at school was compulsory for all students and was integrated across all the different technological areas. Different technology teachers taught their own specialist knowledge and skills but within the shared context of a common brief or theme that carried across each technology subject area. He said they have had to abandon that approach through pressure from senior management to do with timetabling issues, and now junior technology is part of an option programme rather than being compulsory for all; “We’re back to really what we call stitching and stirring, crashing and banging...but we’re still trying to do it with a technology bias." He explains that they are still trying to cover the technology achievement objectives and ‘key competencies’ outlined in the New Zealand Curriculum at both Year 9 and Year 10 level. After doing a lot of research into different secondary school technology facilities in order to design an upgrade of their own technology block, Chester’s teacher explains;

> "You can teach technology in a woodwork or metal workshop, but you can't teach woodwork or metalwork in a technology shop...because students are staying on at school longer, there’s a lot of students that really need vocational type courses, so you really need your room to still stay very much along the lines of a vocational room"

Consequently he has designed his new workshops to retain the heavy industrial equipment, lathes, welders, circular saws etc. that he feels are necessary to deliver the vocational courses they offer. He says different schools in different areas have different student clientele with different needs and consequently may design their technology programmes and facilities in different ways but because they are serving a community that is-

> ...rural or semi-rural and we have a lot of people that are looking towards going back on the family farm and into industry, so our needs are quite different [to urban schools serving white collar communities].

Chester describes the computing skills with programming he did in Year 10 as helping with the work he now does in his apprenticeship, because the tractors he works on are often all computer controlled. He sees there is a call for that link between mechanical and computer programming to be made more clearly at school. He did nothing at all with computers in his automotive class but thinks it would be useful to include, because "especially cars are getting more electronic so something like that would be more useful if kids knew they wanted to go into the mechanical or electronics trade".

When asked to describe the differences between the general design technology classes and the ITO vocational classes offered at his school, Chester says he felt there was too much focus on design and not enough on workshop skills in the design technology class. He thought the class would be very useful if you wanted to pursue a design career because it was "in between," with half theory and half practical. But he thought it taught different skills to those that were taught in the vocational classes. Students would do the planning and designing, "nutting it all out", then go into the workshop to make it. Now he thinks that approach may be better than the "just being told what to do" approach of his vocational classes, but he is still very happy with the classes he chose to do.

His teacher said that since Chester was at school they have actually had to drop the Year 12 design technology class because students were not choosing to do it. He explained that students felt there was too much emphasis on materials research and documentation which over-burdened the project. Students did not see the point of doing research and evaluation when most of the design issues they were asked to explore had obvious solutions. However, he describes the senior graphics programme that is still running and is still attracting relatively good class numbers as;

> “more along the lines of technology than it ever was the old tech. drawing...but it’s very difficult to encompass all the old skills that you still feel students should know, so you therefore tend to teach individually to students what they need to know to succeed in what they’re trying to do rather than teach [the whole class] the whole broad range [of specialist technical drawing knowledge and skills].”

He explains the bright students;

> "will say to you, 'I don’t need to know how to do it all, I need to know is what it is and if I need to know how to do it I'll go and look it up...just tell me what I need to know to recognise it...there is too much knowledge in the world for us to try and learn it, so all we need to know is where we get the knowledge from when we want it."

In the school’s vocational classes Chester’s teacher describes trying to teach and prepare his students for industry by making them aware of the expectations that employers demand of their employees in terms of behaviour, as well as giving them the practical skills they need. He said they do a little theory work but no design. Students are given plans and taught to make projects within certain tolerances, "They're really just like people on a shop floor in as much that 'you give me the plan and I make it' and that's what they are happy to do". However he still emphasises to his students the importance of being critical thinkers, he describes how they might not want or aspire to be academic technologists but they've got to be people who still think. He explains that he always gives his students the example of the problem we now have with leaky homes because carpenters didn’t think and weren’t responsible and proactive about doing a good quality job. He explains that just because an architect may have drawn the plans a certain way doesn't mean to say that if the builder can see an obvious flaw in the plan, he should just keep going regardless. In order to teach this skill Chester’s teacher says he has put a small amount of individual design flexibility (where students can suggest modifications to the standard plans) and stake holder input (they have to discuss their modification ideas with the teacher) into their practical work. This is not documented or assessed in any way because it is not necessary to achieve the unit standard; he has introduced it because he believes it’s just good learning.

Chester perceives the whole practical and theory sides of the unit standards courses he did at school as being tied into apprenticeships. So when he started

his apprenticeship he felt he had a head start on students that had left school earlier. He had only to complete three of the dozen or so unit standards required of the mechanical apprenticeship foundation course provided through the polytechnic because he had already done the others at school. His teacher sees schools being able to give their vocational students valuable and worthwhile qualifications without them having to go to polytechnic and pay polytechnic fees, as hugely beneficial. He believes it an effective way to retain and engage students in school for longer than they might otherwise have done, and then go straight into apprenticeships when they do leave. He says many of his students now are staying at school for longer because;

1. they lack maturity,
2. they can't make up their mind where they're going or what they want to do if they leave
3. they don't consider themselves academic enough to be able to go to university
4. there are not the jobs available to leave to in the current economic climate.

Chester said the unit standards he completed both at school and at Polytechnic, tested things like a student's ability to operate safely in the workshop, and how to structure their working day, plus trade skills. He said learning 'the tricks of the trade', how to use machines correctly, learning your way around the workshop stay with you forever and sets you up for when you are actually working in a workshop context. In Chester's vocational classes the teacher would show the students how to do some practical element of making something in the workshop context, then they would go off and practice the skill themselves. If Chester had difficulty with a task then he would either ask his peers or the teacher for help. His classmates would just tell him what to do whereas the teacher would explain the reasons behind what to do.

Chester's father feels that between home and school, both his children learnt how to use workshop machinery and tools. However, he sees school as having the role of giving students a general education because children don't know what they want to do or what they are going to be. So schools have to keep as many options open for them as possible. He sees schools as being more focussed on the academic pathways of science and literature which suits the children that are

good at that. However, he believes that it is important to give all children the balance of practical subjects too, even if it's just for hobbies or home maintenance; "you've got to broaden peoples' horizons".

Hemi

Background. Hemi grew up on a large farm and went to a small rural primary school. He did all of his secondary schooling in a small (300 students), low socio-economic decile, provincial co-educational school, with approximately seventy percent of the students identifying themselves as of Maori descent. He is the middle son of a family of six children, who have all gone (or are still going) to the same secondary school. One of his elder brothers is a crane driver, another is a fencing contractor and the third is in the army. The whole family identifies strongly with their Maori heritage and well respected whakapapa. Hemi's father runs the farm and his mother left school after Year 11 with a School Certificate qualification. She then went into administration, office work, and was a shorthand typist until she got married and moved out to her husband's family farm where she worked in the woolsheds. She had children and then went back to work in the woolsheds. Once her children were old enough, she started working at a hospital in the kitchen catering area. She had no formal training in hospitality but through her experience working in the kitchens and catering on Marae she felt she had the experience and skill for the job. The hospital put all the staff through any training they needed in health and safety, etc.

Aspirations and inspiration. Hemi said he enjoyed "everything and anything" at school. He explains that so many things he saw in school inspired him and he wanted to do it all. He was only restricted by the limitations of his own timetable and the structure of the school day. He admits he is scared of getting out into the real world without the support network that was available to him at school. Studying at university also scares him because none of his family has had that experience and would not be able to offer him supportive advice about university study. He felt he couldn't even have a conversation about his academic success at school with his parents because the system they went through at school was totally different and they don't know anything about today's system. His mother however, feels that they were "always left in the dark" about what their children did at school.

Hemi is attending an introductory course to get into police training college and his mother would just like him to persevere and complete the course so he knows

whether or not it is for him. She doesn't want him to do the "Maori thing" of going so far then just giving up. She believes she can support him with encouraging words but he has to actually do the work himself. She feels that Hemi "has to be surrounded with [a motivational and supportive environment] all the time" to keep himself motivated. He had that support at school to further himself, but has not got it in the same way now he has left. She thinks he is struggling between a feeling of loyalty to his family and striving to better himself.

Abilities and limitations. Hemi chose the subjects he did at school in his senior years because they were hands-on and he likes doing stuff with his hands. Looking back he suggests it might have been "an easy way out" for him to get through his education by "being hands on and being able to get credits easily".

He felt torn between what pathway to follow because he was receiving encouragement and support at school to follow an academic pathway but was interested in doing hands-on subjects. Even though now he would see a trade's apprenticeship as a good option, at school, he said he would have been less enthusiastic because it wasn't perceived as academic. He considers he still could achieve at university but is still plagued with doubts about his ability to stick to it and complete the course. He is also very nervous about going into debt by getting a student loan.

Hemi is struggling to find employment even though he has all his NCEA qualifications and did very well at school. His mother explains that employers are now looking for staff with experience, which of course school leavers do not have.

> "If he had a choice he'd still be at school, he didn't want to leave...he's struggling with what's required of him from out in the workforce to be able to get a job."

She feels he is nervous about getting a job and the expectations of employers. He is now on the unemployment benefit and she feels he is not getting supported by the Department of Social Welfare to find employment; he is just expected to get out there himself and do it, which she says is demoralising for him.

Hemi's technology teacher is surprised that after leaving school, Hemi hasn't achieved the success he thought he should have. He describes quite a few students in Hemi's year level as just;

> "treading water at the moment, and so that motivation that they had when they were here has just died, and I mean that's one of the things I've had talks with the polytechs about, the fact that the linkage between school and polytech is not there, there's not a natural transition for our kids."

He suggests the barrier of distance and the fact they have to get on a bus to go to polytechnic is one reason they lose motivation, even with the encouragement and help they receive from the school. "We get them buoyed up ready to go on to life and they will not take the step." He suggests this might be because;

> "we molly coddle them too much here...it's because we want them to succeed and whilst they're here they are succeeding because they've got all the support behind them but as soon as you take that support away they collapse."

His teacher states that this is a real dilemma for the school because without teachers' support he feels students would not achieve their qualifications and be able to go on successfully into the world. He suggests that they feel safe and supported by the school no matter what, but in the real world there isn't that same support available, so when things get difficult they aren't prepared and tend just to give up.

Hemi's mother suggests music was something he enjoyed and always achieved well in at school. She has tried to get him to follow it further but even though Hemi also says music has always been a big part of his life, he has ignored her suggestion.

Contextualised learning. Hemi's mother sees herself and many of the children in her family and extended family struggling with mainstream academic education.

> "As a Maori for learning, Maoris are hands-on...mainstream you have to do the academic to get to the practical with Maori its practical and then the academic, we're like, opposite." She would like schools to "find that balance" between the teaching of academic and practical, because "you need one or the other, you can't separate."

She thinks that schools aren't providing the opportunity for Maori students in particular, to develop the skills and talents that they naturally have as Maori, and she stresses the more artistic and musical skills. Hemi reiterates his mother's

view and says; “The practical side helped you remember and recall things for the theory”. In his ITO technology classes Hemi describes the theory as the written testing of what they had to do in their practical work, so things like ‘health and safety on the job site’;

> “It was all written down and you just had to recall what you did...for me, as a Maori practical, I don’t know, imprints on your mind, it’s easy to recall things I suppose.”

Hemi describes technology assessments as testing student’s knowledge of exactly what they had been involved in doing. Whereas it seemed to Hemi that he would study for an assessment in maths, but when he did the assessment the questions seemed to test something completely different to what he had studied and did not have that real life context from which he could draw answers from. Hemi’s teacher also describes seeing his students having difficulty seeing the links with some maths and english work they do, and the real world of their own experience. Consequently they do not really understand it, or the reasons why they have to do it. However, he sees his role as a carpentry teacher as providing opportunities to make those links with other subjects explicit. He explains he achieves this by giving students real world contexts for solving maths problems; like working out volumes for concreting, etc.

> “We make those connections for those kids...and you can see the lights going on...and so that’s where I think we play a very, very important role in those kids futures, in terms of making sense of *all* of their education.”

He stresses his role as support for his students, making them aware of the importance of all their subjects and not to upset their other teachers just because they may not like them.

Hemi’s technology teacher is critical of the general technology curriculum saying he has “never been strong on technology, in its pure form...because some of it is not as real and hands-on as I’d like it to be”. Consequently he feels that some of his students would struggle with the more academic aspects of it and therefore he hasn’t looked that deeply into the new curriculum and assessment matrix.

> The cohorts that we tend to get, although we have a good mixture of academic kids and not so academic kids, they tend to go in that direction [towards manual skills and trades based learning], they don’t all become

> carpenters and engineers, but it gives them a base to go on to polytech, and [with] that base they go into other things.

There are a very small percentage of his schools' students that go on to university and consequently "although everybody likes academic success, and wants people to go on, the school is very realistic about the fact that most of our kids aren't going to go to university." With the new competency based assessment regime, the technology department now is the only reason why many of the schools' students are able to achieve their NCEA qualifications. They are not able to gain enough credits in their core classes to pass and are only achieving through taking technology subjects and gaining the many unit standards credits available there. "The success of our kids at this school is, for a huge amount of our kids, based solely on what happens over in that [the technology] department." He describes the school's management team as being very aware of this and consequently holding the department in high regard, especially since the department is "dealing with the kids who struggle with reading and writing, getting them credits for their NCEA and managing their special needs."

Knowledge and skills learnt in secondary school technology classes. Hemi suggests the focus in junior technology classes was much the same as in senior classes, however at the junior level, "being young you have to learn all the basics before you can progress into the senior level". In senior school Hemi perceives there was more design work involved. In the junior level technology that Hemi did, he said that the whole class would make the same things but there was some room for students to adapt or modify the plans to personalise their projects a little. Hemi felt there was continuity in the style of teaching and the content of the courses in junior and senior technology. His teacher explains that the junior technology programmes follow Ministry of Education curriculum guidelines. However, because in the senior school the technology programmes go towards the vocational ITO courses teachers like to "give a balance" and prepare their students for that focus by starting some ITO unit standards in Year 10.

When asked what skills he learnt in technology; whether he learnt more manual skills about construction, machining, tool use etc or more life skills to do with perseverance, working in a team, etc. Hemi said he definitely learnt both and he still uses the life skills, the "non physical stuff". He specifically talks about how working on a real job in the school context helped him gain an understanding of

when and why certain skills need to be used, what situations require what skill or tool. Senior engineering projects he describes as exactly the same for everyone in the class and designed to give students workshop and machining skills.

Although Hemi's teacher sees the obvious goal of teaching kids to be carpenters and engineers he sees that the technology department's broader task is to give students a good base in work ethic and basic skills so they know what is expected when they go into the workforce and they will be able to hold down a good job or apprenticeship. Skills he lists as examples are;

1. awareness of safety issues,
2. dealing with being under pressure,
3. stretching themselves,
4. independence,
5. communicating and getting on with others,
6. ability to think
7. ability to ask for help or advice.

He sees carpentry and engineering as just a "vehicle" to deliver these more important employability skills or life skills that he also links to the key competencies outlined in the NZC; "A lot of them are skills based things that society wants anyway." When asked about where he sees his students ending up after graduating from high school he describes them as mostly having good jobs and families and having-

> "...become good citizens and really for me that is what it's about...it's about producing somebody who is going to be productive for New Zealand...I'm investing in my own retirement."

Hemi feels he is not using any of the skills or competencies he learnt in technology now because he is unemployed.

> "Having the skills is one thing but having the experience out in the workforce is another, which is where I'm struggling to get out and get the experience. You could do all the courses in the world but you need the actual experience out in the workforce."

Hemi's technology teacher appears aware of this issue and is attempting to address it by still running a building business alongside his school work, where he sometimes gives his senior carpentry students work experience. He sees

himself as providing a role model and “walking the talk” for his students by still being actively involved in the building industry. His involvement with certified builders also provides him the opportunity to place students in apprenticeships or work placements.

In senior carpentry Hemi was involved in a community project to build a sandpit house for the local Kohangareo as an entry into the BCITO annual school competition. Doing this project also gave him credits for his carpentry Level 3 unit standards. He was project manager for a team where one person designed and drew the plans for the house and the other two liaised with the people from the Kohanga and constructed the building once they had approved of the plans and budget. He said that the competition required thorough documented evidence of the negotiation and design process but he was unsure whether the same detailed evidence was required to get the unit standard credits. Hemi’s teacher describes students in this course as having to critically evaluate their work as an integral part of the practical process of making something, but that it wasn’t assessed nearly to the same depth in the unit standards as it is in graphics achievement standards. He explains that at Year 12 and Year 13, students are doing “real jobs for real people” in a real life context and consequently they have to negotiate with, take into account and satisfy the wishes of those people to fulfil the job requirements. Evidence for assessment is documented through taking photographs throughout the process and recording when they spoke to their clients and what was spoken about and decided. There is no qualitative judgement on this work, just a statement to say they have done it or not. The marking and the evidence is then critiqued and externally moderated by the ITO.

Hemi enjoyed the practical side of technology classes because it kept him engaged but he did not enjoy the theory part of senior vocational technology. He describes the theory in engineering as drawing plans, describing the tools and processes used in the practical projects (similar to the BCITO competition paperwork but without the client). Carpentry theory he described as similar because they didn’t have to describe the processes involved in their practical, but just had to copy out theory booklets. They also had to copy some plans and technical drawings of some of the standard projects they made. He didn’t enjoy the copying because “we were writing it but it wasn’t going in.” So when he came to studying for the unit standard tests he said he had to re-read it all because it wasn’t “registering” when he copied it the first time.

When asked to describe the assessments, knowledge and skills involved in the unit standards he completed in his technology programmes, he said “a lot of it was common sense and self-knowledge” and that it was all broken down for you and laid out in simple stages.

Hemi said if he encountered a problem with his practical work he would always just stop and ask the teacher questions before continuing on, even when he was on site at the Kohanga he would ring or text the teacher if he wasn’t there to ask personally. “I wouldn’t just go hmmm, I think I know how to do it, if I don’t know I won’t do it.” There was never any situation that Hemi can remember when the carpentry teacher didn’t know what to do or how to solve the problem. In engineering however the teacher was more obvious in modelling problem solving when the students came up against a difficulty. However, he seemed not to encourage the students to try solving the problem first either. Hemi said;

> “he just made something up and we’d follow him really...he would just figure things out himself and then show us what he did, like not show us how he got there figuring the problem out, he’d go and do it himself then come back and go oah, this is how we’re going to do it.”

When asked whether he felt he learnt any problem solving skills in his technology subjects, Hemi said he thought he had in carpentry but in engineering he said it was left up to students to work things out and if they couldn’t, the teacher worked it out for them.

Hemi said he likes to have the step by step process of doing something spelled out for him first so that he can follow the process and work it out himself. He enjoyed the computer class because that was the approach the teacher took to teach how to use different software programmes. He felt the computer class was similar to the workshop classes but just in a different context.

Darcana

Background. Darcana has no siblings and his parents separated in 2009, when he was in his final year of secondary school. His parents have trades’ backgrounds and did not go to university. When Darcana was born, his mother left full time employment in office administration to work part-time in casual jobs so she could spend more time at home. She now works full time for a consulting engineering firm as their sole office manager. His father worked as an aluminium joiner and is now production manager at a local window factory. Darcana has

done almost all of his schooling in the same urban setting. All his secondary schooling was at a large (1800 students), urban, co-educational school that, in his teacher's words, "serves very much an industrial, working class type community…and very much industrial, trade type people…feeding in to our community here."

Darcana's mother describes his uncle as being "into technology" so whenever they saw him (which was not very often) he was happy to show Darcana his workshop and let him play there. As a child he was always building things and playing with lego. His grandfather bought him a soldering iron when he was quite young and his parents bought him a 'build it yourself robot' magazine that provided electronics modules and kits with assembly instructions. His mother describes him as the type of boy who-

> "...never pulled things apart to see how it works, he's more interested in building it from scratch, or following a diagram and building something."

Darcana's last year was marred with difficulties at home and his parent's marriage break-up. Consequently his mother perceives that he wasn't as focussed at school as he might otherwise have been and didn't do as well as he could have.

Aspirations and inspirations. Very early in his schooling Darcana wanted to be an archaeologist because of an interest he had in ancient cultures like the Egyptians. He still finds the ancient Egyptians and their technological achievements fascinating and has done a lot of thinking and research into the building of the pyramids. He thinks that his interest in engineering came from this early fascination with the pyramids.

His Mother feels he "was always reasonably focussed, that he knew what he wanted to do, 'electronics', from when he was at [primary school] and he just followed that through." She describes Darcana as being "good at what he wanted to do." He enjoyed and wanted to learn Spanish but as he progressed through school he was forced to drop it because there was no space in his timetable to continue both the technology subjects and his Spanish. His Mother said that because Darcana has always known that he wanted to pursue his electronics interest he had no problem choosing subjects at school that would help him in this ambition. At one stage as a way of trying to help him with his maths and to fit in with his interest in biomechanics, she suggested he took

accounting and biology, but again there wasn't the room in his timetable to fit either subject.

Darcana is inspired by the life and inventions of Nikola Tesla. When he was in Year 10, a physics teacher (who was also interested in design, invention and prototyping novel ideas) set up an extra-curricular 'inventors club'. Darcana feels the club was started because he and a few other liked minded students showed an interest and propensity towards using electronics in innovative ways that appealed to his teacher. Darcana's mother says he got on really well with this teacher, which she felt was encouraging for Darcana, "it definitely helps when you connect with your teacher...that probably you know, got the flame from the smouldering."

Darcana now wants to go to university and study electronics, mechatronics and biomechatronic engineering so he can work in inventing new, better and more efficient prosthetic limbs.

Abilities and limitations. Darcana perceives himself as both an academic and a creative 'hands-on' person, a kinaesthetic learner, and therefore he felt his school's senior materials technology course was well suited to his skills and abilities. Darcana feels he had a natural, creative ability in going through the design process and successfully conducting his technology project. He has an innate interest in design and inventing things that goes beyond just school into his home life and hobbies. He has hundreds of sketches and notes of different inventions and design ideas that he has done in his spare time. He talks at length about an idea he has of harnessing the energy of solar flares to help with the increasing demand society has for electricity, and then another idea about a 'biomechatronic hand' for amputees. Darcana feels his early interest in electronics gave him a 'head start' when they started studying it at school.

Darcana's materials technology teacher describes him as "an individual" with ideas and imagination that sometimes ran beyond his practical capability and knowledge base. His teacher felt he showed a lot of potential at school and, if he had someone to mentor him in the right work environment, he would do equally as well-

> "...if he could get good training, he'd be the type of student, he really needs to go down the science line, maybe and get into research and development."

His teacher describes him as a technologist, but more in terms of the novelty and inventiveness of his imagination rather than the down to earth, practical workshop technician, who could "take his idea and make it work." He sees that a big obstacle to Darcana's successful realisation of his potential is getting the required formal tertiary qualifications behind him.

> "He's got great ideas and...has got an ability to get something, get results out of it but they're not necessarily complete and functional…virtual technology…he's got a vision but boiling it down and getting the nuts and bolts to work becomes another issue."

Darcana's mother feels he has always struggled with maths and that has proved a limiting factor for him in achieving his aspirations. When he found out about a special 'enrichment class' he felt indignant that he hadn't been invited to join and that he could have done it. However he describes the students in the class as all from that 'logical side,' "logically based people" who were all good at maths and because he wasn't that good at maths he understands why he wasn't asked to join. His mother suggests that Darcana easily achieves well in subjects that interest him but he has never been engaged with maths and consequently, she proffers, he hasn't made the extra effort or hasn't got the confidence to achieve as well in maths. She has offered to provide him with extra maths tuition but he has not made the most of those offers. After graduating secondary school Darcana had enrolled to do an engineering degree at university but was required to do extra maths classes to fulfil the entry requirements. He failed to engage in these classes and consequently could not gain entrance into his undergraduate degree programme. He is now unemployed but intends to enrol in correspondence school in order to achieve his Level 3 mathematics so he can re-enrol in university.

When Darcana was in his last two years of schooling he offered free tutoring to students who were struggling in electronics, basic word processing and physics. However, in his last year of school Darcana got a new physics teacher. His mother thinks this teacher felt Darcana was struggling and she only wanted to keep the students who she felt were capable of achieving well in the class. In the end Darcana left the class and enrolled himself in the school's gateway programme. When his mother found out she went to the school's management to discuss what had happened. She spoke to the Deputy Principal who said that "he wouldn't have probably allowed Darcana to go to [gateway] because he's

more of an academic student." They tried to get him back into the new teacher's physics class but it was too late, he had missed out on too much of the year's programme by then. The gateway programme was supposed to have placed him in work experience with an electronics firm but that didn't work out in the end.

Contextualised learning. Darcana has found the traditional mathematics curriculum difficult to engage with. He failed to complete the university bridging course to get his Level 3maths credits that would allow him entry into an engineering degree programme. He thinks it's more psychological than anything else when dealing with something that is just pure logic it just doesn't make the same sense.

> "Although I have like a logical side when it comes to my creativity...I need to have a reason as to why I'm doing this...but when it comes to just pure logic if it doesn't have a physical reason as to why we're working this out then my brain kind of just switches off."

He described this 'logical side' as being "more detached and I'm not here as long as something has a physical application I'm fine." Numbers to him are "not real...it's all in your head" they exist in "a dimension in which we can't exist in." When one of his classmates asked their Year 11 maths teacher where they would use the maths problem they were learning, the teacher replied they would only ever need it if they became maths teachers themselves.

Darcana's mother realised that he was struggling with pure Maths but when it was pointed out that there was a lot of maths in electronics and physics she said "he seems to be able to apply the physics to the project, but when it comes to, you need the maths to do this course [at university] its [different]."

It wasn't until Darcana's last year of school that he was given an explanation he was comfortable with about the usefulness of much of the main stream education he had been through;

> [it was] more to do with broadening your mind to that logical side, rather than just working it out, I think if I had that sort of thinking before I would have grasped it a little more easily...I guess I need to find someone who can sort of, teach me the boring stuff, but in a way that I can do it creatively.

Darcana tells an anecdote about one of his classmates who found normal academic subjects very difficult and had not achieved in main stream education at all, but who was very talented and capable in automotive. The teachers gave him numeracy and literacy assessment standards that related to his interest and skill in the automotive context and he successfully completed his schooling and went on to an automotive apprenticeship. Darcana describes this as a common strategy for 'gateway' students;

> If they had a passion for a particular thing they were always given a paper, or given papers around this certain thing and they were introduced to, or more into the real world application of that particular interest.

Darcana's teacher echoes this perception by saying that students in the 'Tech Academy' are "mainly students who are more hands-on students so they struggle in the maths and English." He sees these students as having a greater chance of attaining their maths and English qualifications when they are in their own class and not mixed in with the mainstream maths and English classes, because the classes can be better tailored to their learning needs and the specific skills they will require when they join the workforce, for example report writing. Many of the 'Tech Academy' students are being taken up successfully into the workforce, or going on to polytechnic and gaining further trades qualifications, in spite of businesses struggling with the current economic downturn. Darcana's teacher explained;

> "At the end of the day, for most kids that's what we want, get them into the workplace, get them an apprenticeship or get them into the Polytech."

Darcana also describes "losing information that he should know" when faced with the pressure of trying to recall it for a test or examination, he felt he couldn't recall knowledge without some sort of aide or reminder to contextualise the knowledge with something tangible. With this discussion of the value of contextualising knowledge and the dichotomy he sees between the 'logical side' and the 'creative side', Darcana proffers that education should be able to make knowledge easily accessible to students; "if you can build a bridge, it works."

Knowledge and skills learnt in secondary school technology classes.
Darcana explains that for him most of the technology classes taught the subject specific knowledge and skills involved in those areas. With materials technology it depended on what your client wanted to what skills and knowledge you

needed; “you’d need to involve your skills from engineering, from [other subjects].” With materials technology; “it went into electronics but not enough as to like, sort of illuminate electronics technology by itself.” So if you didn’t do the electronics class you would have to do the research to understand what was needed for the project you were designing for your client, you would “need to like, do the research into the things that you didn’t know, and the things you did know, you’d need to prove that it was correct”. Darcana says every step in the design and modification process had to be discussed with their client and each design development only went ahead with the client’s approval.

In materials technology he feels he was taught to consider a wide range of alternative solutions and not just go with the first design idea he had. His teacher too describes this as a key skill he attempts to teach his students as it is something that does not seem to come naturally to most of them;

> “Most of the students we are seeing now are…good, creative hands-on students, not so innovative necessarily in the designing process of evolving…developing, feeding back, developing, feeding back…”

Because most students have difficulty with this iterative design and development process Darcana’s teacher tries to get them out of the mind-set of just going with the first idea they have and “jumping straight in” without having thought through all the implications, and different possibilities or consequences of doing it that particular way. He sees his role as a kind of devil’s advocate to make them think about all the implications, pitfalls, possible improvements or efficiencies they could make with their design.

He also teaches students the planning and management of a project so that it will come together successfully without too many unforeseen difficulties causing problems. He teaches them to be critical thinkers when faced with the task of designing and making their technology projects. Modelling is an important tool he teaches students to use to test their ideas. As a consequence he finds the general technology classes waste less material than the workshop classes, where students think they know what they have to do because they are working from a plan but end up making more mistakes.

Darcana perceived the ITO subjects as not as challenging as Materials technology because “you were told how to make [the projects], you don’t run into problems you have to fix” and “there was no client based work at all.” His teacher

also sees the skills and competencies he teaches in the Year 11 workshop skills classes and the ITO unit standards courses (where students are given set plans from which they fabricate their projects), as different from the skills taught in general materials technology classes:

> "The unit standard type programmes are skills which are just fully more hands-on whereas with the technology you are trying to develop the thinking, problem solving, the analytical, why are you doing this…and using that approach, modification of original [existing] technologies."

Even in ITO electronics, where Darcana says some of the 'why things happen' questions were asked, the answers were still given by the teacher rather than students working it out for themselves. For success in the electronics course in Year 11Darcana said that you had to enjoy the subject because there was a lot of 'theory based' learning that might have discouraged students who only wanted to do the practical.

He suggests two thirds of his final materials technology project was written work and one third practical. "Pretty much everything I did in practice I had to document and write down." His teacher describes many of his materials technology students finding the documenting of their design process difficult and he tends to suggest the strategy of drawing and sketching what they've done and putting a couple of notes around the drawings as opposed to writing it up, as an easier more achievable option. Darcana however, enjoyed the designing, drawing and writing part actually more than the making part. He did nevertheless, value the making because it revealed flaws in the design that he may not have otherwise realised were there. He also felt motivated to complete his Year 13 general technology project because he saw it as an opportunity to make something that would have a real beneficial impact on his client's life.

Because Darcana felt uncomfortable and unsure about using some of the workshop machinery to fabricate his designs, he sometimes asked other students to use them for him. He felt more comfortable using hand tools but realised for some jobs he needed the machinery to achieve what he wanted. His teacher too, said he would help guide him with the fabrication and the realisation of his ideas in the most effective and efficient way.

He solved problems in his materials technology project through researching around the issue or just "meditating the idea" or "sleeping on it" and allowing his

brain to work on the problem sub-consciously. Another problem solving strategy he employed was looking to see if he could find examples of similar problems that had been solved already, then adapting or modifying those solutions to fit his context. He would go through a fault finding process with his electronics projects himself, and if he still couldn't find what the problem was, he asked the teacher for help. The teacher, if she couldn't solve the problem either, went to an expert from university and asked him. He also used the expertise of his old teacher who no longer taught at the school, but who he could still contact at home when he came to problems that he could not easily solve himself. With his final technology project he had access to different teachers with different areas of expertise because he needed specialist advice, knowledge and skill that went beyond the experience and expertise of just one teacher. He did a lot of brainstorming with his technology teacher to generate ideas.

Darcana perceives the skills he learnt in junior technology were very useful later in school and to what he does now with his own interest in invention. He describes learning more basic manual skills and machine use in Year 9& 10 like learning how to turn wood on a lathe and chiselling. Projects he remembers from these junior classes were fairly tightly defined but did allow students a good deal of their own design input. For example, in Year 9 they designed and made something that could hold either rings or necklaces where they could use whatever materials they liked as long as they were readily available. There was also a catapult project where the students worked in groups of two or three.

Darcana's teacher describes the junior hard materials programme as based around traditional practical projects but adapted to include the achievement objectives of the curriculum. "We're taking the good stuff out of stuff which we've already done and re-writing them." So the practical skills that have been done all along are still being taught but the generic technological skills outlined in the curriculum; the designing, planning and evaluating, have also been included. When it was put to Darcana that the junior classes seemed to be setting students up to continue with academic technology he said the focus appeared to him more about learning practical, manual skills like-

> "...this is how we properly use these tools...it wasn't until NCEA level one...well it was in electronics and the sciences, that we were actually asked...well 'why is this happening?'"

To Darcana it was natural to ask the 'why' questions and in the junior school he was the one who asked the teachers those questions. However, in the senior school he found that the teachers were asking those 'why' questions of the students and expected them to "either work it out yourself or you had to find someone who knew the answer." When he was primary school age he used to get electronic kitsets and books that helped him understand the 'why' questions in electronics.

Darcana's mother sees him now as having developed perseverance and an ability to see a project through to its conclusion. She also sees he has developed good problem solving skills and an ability to know when and who would be best to access when he needs help. She can't identify whether these skills were already innate in him or whether his electronics teacher fostered them or whether his doing technology subjects fostered them, or whether it's something he picked up from home.

She perceives his manual skills as good and the work he does as neat and well executed.

> "If something's well made it's partly to do with Darcana wanting to do a good job, but it's also, maybe expectations of what the teacher wants you to do and how they've taught them to do it."

She believes the skills he learnt at school would be useful if he had had the opportunity to pursue his aspirations in the electronics field "it's just getting the opportunity and stuff to show someone."

Emma

Background. Emma is the eldest daughter in her family, and she has two younger brothers. She attended a small provincial, low decile school and in her final year there, she was elected to be one of the head students. Her two brothers still attend the same school. Because her family don't live in the school's catchment area it became "a school of choice" for Emma's parents to send their children there. They chose the school because, as her mother explains; it gives their children-

> "...a sense of self-worth and they can believe in themselves, it's not just an academic thing...The feeling of belonging [to the school community]

has helped all of my children, actually, to continue on with their education."

Emma's mother applied for and was accepted into Teachers College after she graduated secondary school. She did a holiday job in a law firm until Teachers college started but the firm offered to put her through legal executive training so she did that instead. She worked at that firm for a few years, and then moved to Australia to work for a law firm there. She returned to New Zealand and started working for a bank. Once she had her three children she stopped work to bring them up. When they all had reached school age, she went back to part time work and now works on a casual basis at a credit union.

Emma's father was self-employed running a commercial cleaning business, for which Emma's mother did the books. He sold the business and is now a leading hand in a factory managing the cleaning staff.

Emma is now in her first year of studying law and business studies at University. Her mother said she worked very hard to gain scholarships and believes that people value things more if they have to work hard to attain them.

Aspirations and inspirations. Emma explains she has always wanted to be an entrepreneur and start her own business. Her choosing graphics and art was in no way related to a need she felt to learn skills relevant to her aspirations, "it doesn't align itself with graphics that I can see". She chose graphics and art in senior school because;

1. She enjoyed drawing and 'arty things'
2. She felt she had that interest and innate ability.
3. She felt she could achieve high marks because it was clearer what she needed to do. Whereas in other achievement standard subjects she felt it wasn't as clear what was required to get merit and excellence.

In graphics, she felt the teacher helped analyse, interpret, and clarify the requirements of the achievement standards because "when you read it [the achievement standard] without assistance it's kind of complex". Over the duration of the year's work Emma says he pointed her in the right direction as to where to take her project work.

Emma's mother explains all their children have received the same message from their parents; that "you have to be self-motivated, you get out what you put in and

you're responsible for your own life." Saying that, she describes all her three children as very different from each other, with different levels of competency and consequently she believes they take different things from the same school subject.

Emma's mother sees that she and her husband have a lot of responsibility in guiding their children into taking appropriate school subjects and consequently, career paths that will suit them and allow them the greatest opportunity for success and happiness. She feels this responsibility is complicated by the need to balance their recommendations with the desire to give them the freedom to make their own informed choices.

> "As a parent you are their primary guide...you need to know your children so you know where to steer them. I've got three totally different children, I've got one who is arty and academic, I've got one who is hands-on...and I have another one who is music and IT...they all need three different types of subjects."

Emma's mother also believes she found very good role models in her school's female Principal and art teacher, in terms of modelling the personal traits of self discipline and striving to achieve one's goals. Her mother felt they also had an influence on what subjects Emma took at school, and what she was interested in doing after she left school. Emma's love of art and respect for her art teacher caused her to look seriously into doing art at university but she was put off by the lack of employment opportunities for fine art's graduates; she explains she didn't want to be an art teacher herself. Emma's mother suggests an ex-pupil from Emma's school who had done law at university and the Principal (who is an economics teacher) may also have had some influence on her decision to do law and business studies instead.

Abilities and limitations. Emma was dux of the school and always had a strong belief in her own ability. Emma's mother describes her as being-

> "...particular in her work...very self-motivated and academic...She likes to be the best...She would have got lost in a big school, [going to a small, provincial school] has helped her self-esteem [where there is a more familiar, less formally and strictly structured learning environment]."

In spite of having to take accounting by correspondence in Year 11, because there were not enough students who were interested in taking the subject to justify running a regular class, she excelled.

Her Graphics teacher commented on Emma's natural drawing and artistic ability that he felt was complimented by her motivation to excel and consequent receptiveness to his advice and teaching. Unlike many of his other students, he felt that Emma distinguished herself through the careful documentation and justification of her designerly thinking and the higher level thought processes that the class engaged with in working on their design projects.

Contextualised learning. Emma describes being able to transfer knowledge and skills from other subjects and use them within the context of her Year 13 Graphics project. Art gave her an ability to look at and describe different areas and aspects of design that she could apply to graphics and vice versa. She used accounting and economics skills to cost out materials and look at cost efficiency factors in her design; "Guess it was kinda like the real life application of maths, to like a situation". She gained skills in using computer programmes like 'photoshop' and was able to transfer those skills between different subjects like art, graphics and a computing class. Her Maths teacher taught her to use 'Excel', which she then incorporated into analysing questionnaires that she did in her graphics work.

Because Emma's mother was her client in her Year 13 Graphics project, and saw first-hand the progression of her design work and the knowledge and skills that Emma used in it, she also commented on the usefulness and transferability of that knowledge and those skills to and from other subject areas.

Emma's teacher believes contextualising the projects his students work on in the most real world and engaging contexts encourages his students to bring their own experiences, as well as knowledge and skills from other subjects into their graphics design work. He said the self directed Year 13 project where the student had to find and work with their own client to design something that that client wanted, was the culmination and application of all the subject specific knowledge and skills he had taught in the preceding years and the most difficult for the students to achieve in, because of the high level of self-motivation required of them.

Knowledge and skills learnt in secondary school technology classes.

Emma explains that junior technology gave her the opportunity to do practical things that she wouldn't normally have done or even looked to do, like cutting wood, it's "given me a small amount of experience...not so scary now with it....I could use later in life". She did a compulsory cooking short course at Year 9 about which she says she cannot remember any of the cooking skills taught and she is still not a very good cook. On reflection she suggests that even though she can't remember the subject specific knowledge and skills she learnt in her cooking class, it may have helped her with teamwork and collaborative working together as they had to work in pairs quite often. She explains junior level work was more like general knowledge level but as she progressed into senior school it "got harder and the things we did got more difficult."

Emma describes the benefits to her university studies of studying graphics at school, as gaining skills in self management, research, differentiating between useful and superfluous information, collating that information, and project management;

> "When I had to go all the way through from beginning to end of the project and choose a project myself, it helped me kinda gain an idea of how to do a project like that...having to look at all the different options and having to assess each option and see which one is the most, the best option to choose and then why it's the best option, and then how to improve that option and things like that."

Sometimes she felt the final self-directed Year 13 project was too much work to organise and make sense of, she describes getting lost in what to do next and being overwhelmed by the scope of the work involved. She felt she managed her work load and time more effectively in Year 11 than Year 13 because in Year 13 she had many more distractions, commitments and demands on her time. Her mother also points out that because of the small size of the school, Emma had to do some subjects (not technology) through correspondence. She believes this has made her more self-disciplined and motivated which is very useful in the university environment where teachers aren't actively encouraging you to work as they do at school.

In Year 11 and 12 graphics, Emma describes students being set the same design project with the same set of specifications but after going through their own design process they all ended up with different variations of design solution.

Emma also describes other requirements of the graphics course as doing a research essay on a design era, annotation, critical analysis and evaluation of her designs in terms of design features like sustainability and durability. She thinks there was a high expectation of students' literacy level. She either relied on her own general knowledge to guide her work or if she didn't know something she would research it "research kinda guided our writing". She explains that doing the more defined design projects set by the teacher in Year 11 and Year 12 helped her gain skills, confidence and ability to do the more independently driven project at year 13. She could look back at what she did and how she did previous projects and transfer the skills and knowledge to what she did at Year 13. She can see the learning that occurred now, looking back, but wasn't aware of it at the time. Emma perceives graphics taught her to look at the "big picture" the process and steps to follow to manage a big project as well as what to take into account, the principles behind good design like fitness for purpose, suitability of different materials. Brainstorming and looking at things from different angles, and exploring different ideas, instead of going through a linear process with one idea.

Emma's mother has had the experience of seeing two of her children do Year 11 graphics at the same school and comments that her son, who is "not a drawer and you can see it in his graphics work", nevertheless will benefit from doing the subject if he chooses building as a career pathway because it provides him with the skills and knowledge of how to "get your angles all right and everything like that". Also with drawing and reading plans and having a basic working knowledge of things like interior design and how colour, texture etc work together and how modelling can help clarify design ideas. She perceives that as well as manual drawing skills graphics taught the process of design that she sees evident in the number of alternative designs Emma did for her projects. Her mother feels Emma learnt self-control in graphics in terms of not stopping until she was happy with what she had done. However because her son hasn't the same desire to excel he will not have learnt to the same level as Emma; "he'll only learn to the level he's comfortable with."

Because of the small numbers in her graphics class Emma says it was easy just to ask the teacher if she came across a problem or something that she did not know how to do, but she said that of course she would try and solve the problems first herself; "I wouldn't just, as soon as I have a problem, shoot off to the teacher". In one situation the teacher suggested a book she could use to find out

a particular drawing method, they both looked it up and “discussed how it would work because he hadn’t drawn one before”, then he sketched out an idea to draw it and she had to interpret that with the information from the book and her own prior knowledge to solve the technical drawing problem. She could go back to the teacher for further help if needed. Sarah perceived her teacher as “a guide” to help clarify different points “get a better view of what I had to do....not showing really like what my project should look like but more like a broader view.”

Emma perceives some technology subjects as a lot harder than others;

> “Cooking, where you do a lot of unit standards seemed fairly simple as a subject...compared to graphics where achievement standards are used, seems harder in comparison.”

She has the perception that achievement standards subjects are more academically rigorous than unit standards as a result of the graded assessment structure;

> “If I like, just wanted to ‘achieve’ in graphics, it might just be a similar difficulty as say cooking. But when you’re trying to achieve higher grades it seems more difficult.”

She did a senior level computing class that was a unit standards based National Certificate in Year 12 and 13. She describes the course as teaching students how to use different computer programmes, create documents and do web based research. She felt the course was not at all like graphics where you were just given the starting point, because it was very prescriptive, “step by step...no variation from the path...wasn’t like the whole project was yours”. She describes students as having to do things because they were told to do them rather than actually needing to do them to progress or benefit their projects. This had the effect that the final results of the students’ projects were very similar for everyone in the class. Emma thinks that the difference in approach to graphics was because the computing course was a unit standards based course. With achievement standards the amount of effort the students put in varied because of the availability of getting higher grades. With unit standards you “did it, did the amount to achieve, then finish”. In comparing the learning done in computers to that done in graphics, she suggests graphics was more about “how to think about a project not just how to do something” and “computers wasn’t higher level learning.”

Emma's mother values the school and its teachers more for the holistic influence on the development of her children as positive members of society rather than just for their role to deliver the academic curriculum. She sees the most important skills Emma learnt at school and the most useful to her now, as the ability 'to get on with anyone', self confidence and leadership skills. Because the school has a high ratio of Maori and children from less affluent backgrounds, Emma's mother feels that her children are more rounded and aware of what it is to be a New Zealander. Also she feels that being at a smaller school provided Emma with more opportunities to take on leadership roles and different roles of responsibility that in other larger schools would have been more highly contested.

Lorenzo

Background. Lorenzo went to the same small, provincial secondary school as his Father had attended. He left school after completing year 12. He was a 'hammer hand' for a building firm for 6 months with the promise of an apprenticeship, but he was laid off before starting the apprenticeship formally. He has also done lots of other short term manual work. He did 18 months with an engineering firm but left because he could earn more money doing insulation installation work. He's been installing house insulation for the last three years. The skills and knowledge he uses for the insulation job he describes as "basic building...like joist sizes, how a house is built...what not to touch because it'll either hurt you or break the building." However, he recognises that even though the money is good, there are really no opportunities for furthering yourself or promotion unless you buy the business and run it yourself. Now, with more maturity and a family to support, he would like to have "a trade or something up my sleeve, like a piece of paper that says 'I know shit'." He is now saving money to study for his helicopter pilot licence.

Lorenzo's father left school after getting his school certificate qualification at the end of year 11. His own father got him an apprenticeship as a carpenter because he didn't really know what he wanted to do when he left school. In his early twenties once he had matured a little and had more of an idea of what sort of vocation he wanted to pursue, he retrained as a traffic officer and then policeman. He spent twenty plus years in the police force then retrained again as a social worker.

Lorenzo's parents described their parenting style as providing support for their children to make their own choices and then supporting them in those choices.

Because Lorenzo's grandfather had made employment choices for his son and directed him into building, Lorenzo's father says he probably took the opposite approach with his own children and allowed them the freedom to choose for themselves even if they did not know what they really wanted to do.

Aspirations and inspirations. Lorenzo always wanted to be a builder at school and this definitely influenced the decisions he made about what subjects he took. He said he always had in the back of his head to go to the Airforce and get his helicopter pilot's license if the building didn't work out, and for that reason he took physics in Year 12. However, he decided not to apply for the Airforce in the end, because of the rigorous health check that, due to his slightly impaired vision in one eye, he thought he might fail. Lorenzo discussed with his father about what subjects to take to attain his goals and consequently took "design technology" (graphics) and the "woodworking" (carpentry). He still has a good relationship with his parents and talks to them about issues he faces currently. His father feels that Lorenzo has always followed his own path without being overly influenced by others. He describes Lorenzo as having "always liked to get involved in doing [practical, hands-on] things," and when he left school he left with the intention of getting an apprenticeship as a joiner but that fell through. His parents also helped him into getting a trial with a building firm but they ended up not giving him an apprenticeship either. Lorenzo's parents feel that it was a result of the difficult economic environment of the time and that firms were unwilling to take on new apprentices. Lorenzo's father confirms Lorenzo's long standing desire to become a helicopter pilot describing it as having always been in Lorenzo's mind as a long term goal ever since he was at school.

Lorenzo chose the computing courses he did at school because he liked the subject. He describes designing a website for a wooden toy business that his parents had when he was at school. He also had an interest in cars but, as automotive classes were not offered at his school, that interest never grew beyond being more than just a hobby.

Another inspiration for Lorenzo choosing the subjects he did at school was the fact that his father had been a builder. Lorenzo said he learnt most of his woodworking hand skills and the enjoyment of making things, through his father. Consequently, he found the practical subjects at school easy and the 'easiness' made those subjects attractive. Looking back he said he enjoyed more the 'design technology' rather than the carpentry because "I like drawing but

woodwork was kinda too simple." He was used to doing big projects working with his father, whereas at school, they started off just doing small projects. He would have liked to have done big projects like 'habitat for humanity', where you can gain more of a sense of accomplishment when you finish it and you can look back at it and think "I helped do that, a big ass building." If something was too easy he didn't enjoy it so much because "I didn't feel like I was *doing* anything...I always wanted a challenge."

Abilities and limitations. Lorenzo perceived he had the intelligence to achieve well academically at school. He admits though he "slacked off" a little in the senior school, which is why he failed in physics at Year 12 even though he enjoyed the intellectual challenge of it. "I like using my head, my brains, everyone thinks I'm a brainy person," but he also wanted the challenge of being a "physical worker".

His father also shares this belief in Lorenzo's academic ability, saying he has "every ability to be right up there [academically]", but qualifies this by explaining the issue for Lorenzo is whether or not he actually chooses to apply this academic ability. He feels that Lorenzo also has very good ability in drawing and graphics, which he thinks started from his grandmother, who was an artist. His graphics teacher remembers him as a talented and intelligent student who, like many teenage boys, just did enough work to get a pass mark. He felt he was not interested in putting the extra effort into the presentation and documentation of the higher level thinking processes that he was involved with when he worked on his design projects.

Contextualised learning. Being a builder seemed a more real, attainable option for Lorenzo at school because he had the experience of his father to draw from, whereas joining the Airforce to become a helicopter pilot would have been going into the unknown. So doing physics even though he knew it would be good to have for his flying, felt like it wasn't really relevant to his real world and life experience. "Woodworking is my Dad and I kinda had something to relate to, but physics not so much it's just a subject that you need."

Lorenzo's carpentry teacher sees the technology department (perhaps better than other departments) as doing a good job in making their subjects relevant to the real world of their students and teaching 'employability' skills and core competencies. He believes students can use these skills in later life to be good

employees and productive members of society because what the department teaches is linked with the real world and real experiences. He says the students;

> "need a link or a tie and one of the advantages that we have is that we've all been in industry, so you know, technology teachers normally come from industry...so when a tech teacher is talking to their kids, the kids know that what they're saying is work experience...In terms of jobs and what expectations employers have and how things happen and what the kids perceive is the real world and how that links with what parents say because their parents are, you know a lot of our kids parents are manual workers, then I think it helps those links with those kids."

Lorenzo's carpentry teacher explains that this may not be the same for an English or Maths teacher who may have gone through school, gone to university and come straight back to school.

Knowledge and skills learnt in secondary school technology classes. In junior level technology classes (Year 9 and Year 10), Lorenzo remembers he had to do short courses of everything "so we could grab a hold of what was to come." He felt both junior and senior technology were involved in learning similar skills, and as you progressed through the year levels the work and skill level just progressively built on what had come before.

Lorenzo said looking back now after some time in the workforce, if he was to go back to school, he would have taken engineering as well, because when he left school he got a job in an engineering workshop for 18 months which he enjoyed. He thinks he would have enjoyed it even more if he had started with a few more of the skills that he heard from other students, were taught in the senior school engineering course. He describes the skills he needed as mainly how to use workshop machines for flatbed milling and lathing.

Skills that he knew hadn't been taught at school but he did require in the engineering job, were all to do with how to use the multi-million dollar CNC machines. These machines required pre-programming in CAD with different codes to make the machines do what you wanted them to do (which he described as being a very difficult skill to learn). Lorenzo described that you needed both the knowledge of how to programme a computer and the background knowledge of what each of the machines that were controlled by the computer, did, and what the properties and limitations of the materials that you were machining, were. All

this knowledge and the skills he needed were taught by his employer whilst he was on the job.

In school Graphics classes Lorenzo perceives he was taught design skills, and how to "pre-plan [a building] and know exactly what needs to go where...and how to read plans." Lorenzo valued these skills when he left school and started work on a building site because they gave him a head start knowing what to do. Also in the insulation installation job he is doing now, he values the skills he learnt in graphics because he can communicate with other trades people using sketches and visual communication to explain what he wants, or how he wants a job done. Lorenzo remembers designing and making a pull-along wooden toy in his Year 11 graphics class that he described as halfway "between woodworking and graphics". Lorenzo's carpentry teacher also perceives the type of skills and knowledge assessed by achievement standards in the graphics programme and ITO unit standards programmes as very similar "because the cross-overs and ties between the two subjects are huge." He gives examples of some of the skills in graphics as reading plans, knowing what orthographic and isometric drawing is about, sketching, and the ability to draw in 3D so a client can know what a design might look like.

In carpentry Lorenzo talks about learning the basic practical skills that a builder needs to know to be able to build, but he feels he already knew most of it from working with his father. Although his father describes Lorenzo's upbringing as being involved with a lot of building, fencing and hands-on work at home, Lorenzo's father feels doing the trades courses at school added more depth to his practical experience. His carpentry teacher also perceives a large percentage of what he teaches to be those basic practical carpentry skills like the use of machines, tools, hand skills, how to read plans, etc. He models the correct use of tools and equipment, shows students how to do things properly then monitors their practice and expects them to help and teach each other as a way of reinforcing their own knowledge and skill alongside learning independent thinking skills. The class drew copies of plans and helped build a deck, a set of stairs and covered balcony for the staffroom, and a pergola to go over a teacher's deck area at his home. Lorenzo says;

> "We all did the same thing to learn the skills, but when it came to the [graphics] projects, that was kind of our own thing; we had to use the skills to design our idea."

Lorenzo's carpentry teacher explains there is not very much design work in his ITO class because they are generally working off already completed plans, but he still stresses the importance of design in building because "sometimes people want to know alternatives". He would like some sort of graphics or technical drawing to be compulsory for students doing ITO courses and says there are unit standards available but not the time to deliver them.

Lorenzo found doing the theory work and written tests in his Year 12 Carpentry class really boring because he said he knew everything and could explain it if asked, but found writing it out pointless. Lorenzo suggests an even stronger emphasis on safety in the work place is needed at school to make sure students are prepared for the real world of employment on building sites.

The first practical project they made in carpentry was an oil-stone box project from a predetermined set of drawings. In comparing this to the graphics projects he did in the same year, Lorenzo felt he gained more a sense of accomplishment designing and making his dragon pull-along toy project. He explained the box was not so much of a challenge because;

> "if you kinda got stuck you just look over and think ah yeah sweet as, copy someone else, but the dragon [pull-along toy] was hard because there's more inner workings and sizes and stuff *you* have to think about for your own thing. It's the same as a building...you have to think of everything while you're doing it...it's more of a challenge."

However he says he still has the oil-stone box and finds it really useful even now, whereas he left the dragon behind at school.

He also said he asked lots of questions to his teachers if he got stuck, but because the teacher was generally always busy he would look first to see if other students had already done what he was stuck with. Also particularly in the junior years he felt more comfortable asking his friends rather than asking the 'big, scary teacher.' Lorenzo said he would try and solve problems himself "but it's a lot easier to ask the tutor." Sometimes they would give you a 'slight hint' about how to solve the problem yourself and other times they would just give you the answer straight away. He thinks the hinting method makes the learning "stick in your brain more because you kinda think how to come up with the answer, where if you get told the answer you have to remember the answer."

Lorenzo's father tells an anecdote about how when Lorenzo wanted a particular car but could not afford one, he went out and bought the body shell and a motor and-

> "...without any mechanical knowledge, he then proceeded to install the motor in the car and changed it from an automatic to a manual gearbox and did the whole thing himself and got it going."

When asked where Lorenzo learnt these skills since he never did any automotive engineering at school, his father suggests it was a combination of;

1. him being a "tinkerer" himself and role modelling that skill at home,
2. Lorenzo doing "trade stuff at school…gives them a little bit of practical application that you can do bits and pieces and…tinker and figure it out", and
3. Lorenzo's own personality and dogged perseverance.

When Lorenzo was growing up his father describes them as doing "a heap of hands-on stuff all the time, so he grew up with that sort of attitude" and Lorenzo worked alongside his father on whatever project they were involved with at the time. His father describes him as-

> "...always a bit of an experimenter around the place…so investigating how something worked or if he could make it work better wasn't new to him."

His father feels that school allowed him to keep developing his ability at problem-solving and using his own talents and ability to apply to a particular project. Linking with this idea, one of the skills his graphics teacher describes teaching in the pull-along to project was using mock-ups and models to help identify design problems and help students to come up with ideas to solve those problems.

That concludes the presentation of the findings the following chapter will analyse and discuss the themes that immerge from this data.

Chapter 5: Analysis and Discussion

Introduction

This chapter contains analysis and discussion of the findings presented in the previous chapter and has been arranged in two main sections. The first section will deal with analysis and discussion around the research question:

> What factors influenced these five young people in the choices they made regarding their secondary school technology education?

The second section will deal with the remaining two research questions together, them being:

> What knowledge and skills were taught in these young peoples' secondary school general and vocational technology education programmes?
>
> How do these young people perceive the relevance and usefulness of the knowledge and skills they were taught in their technology education?

Factors that have Influenced the Students' Choices in their Technology Education

The data presented in the findings chapter above, reported the influences on students choices under the headings 'Background', 'Aspirations and Inspiration' and 'Abilities and Limitations'. The analysis and discussion that follows will draw all these themes together in order to illustrate the interplay of the students' own agency and the influence of institutional and social structure on their lives and educational choices. The discussion will be contextualised within socio-cultural theory, Bourdieu's (1977) concepts of habitus and cultural capital and Taylor's (2008) concept of vocational habitus.

In discussing the factors that influence students when they choose whether to take vocational technology education programmes or general technology programmes at school, the first issue that arises is whether or not the students are making their own agentic decisions. If the students' sense of their own agency and self-determination has been an important influence on their choices, then how important are socio-political and cultural structures in influencing these choices? There are two main themes evident in the research data described in

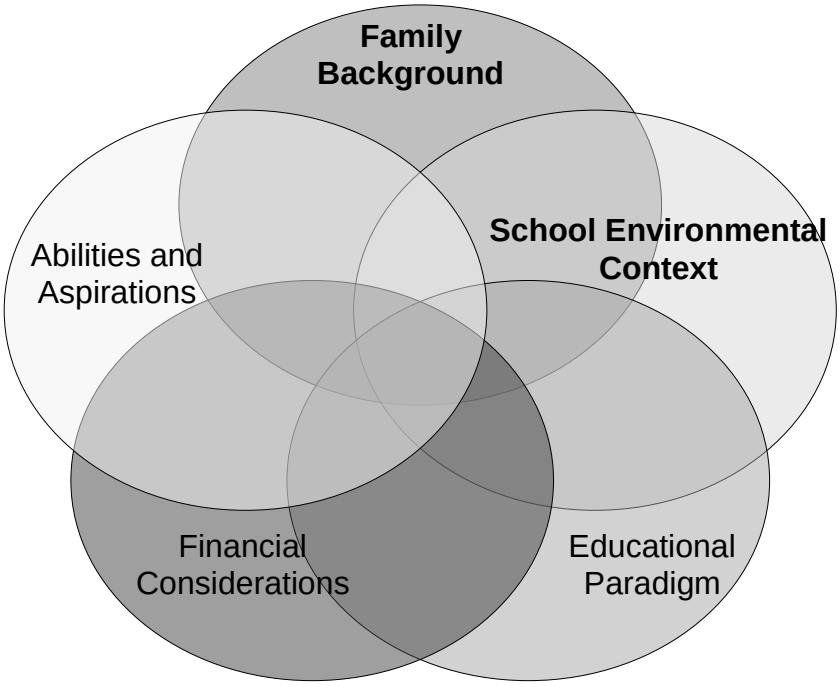
the chapter above that have bearing on these questions: one is the students' family background and the social and cultural capital they bring to their schooling from home, the other is the environmental context of each school, its rural or urban setting, and the average socio-economic status of its contributing families. Linked to these themes are sub-themes of the students' own abilities and aspirations, financial considerations the students and their families have about investing in their education, and the educational paradigm or philosophies valued by school management and teachers that underpin the schools' technology programmes. Figure 1 provides a visual representation of this discussion.

Wyn and Dwyer (1999) report that recent studies indicate many young people have an increasing sense of their own self determination and agency when they make choices about their education and future career prospects. However, what the future holds for them is a lot less predictable than for previous generations. Students in these case studies appear to be making some agentic, pragmatic decisions about the career path they want to follow and whether or not to go to university. However, to a large degree, any sense of self-determined agency they do have is somewhat overpowered by other factors, as the realities of their lives appear much more defined by the confines of socio-political and cultural structures.

Evans' (2002) concept of 'bounded agency' seems very applicable and relevant to these case studies. She describes student's decision making being "based on complex interactions of individual agency and structural influences" (p.247). Her study looks at student transitions through a lens of "...agency as a 'socially situated' process with young adults undoubtedly manifesting a sense of agency, but there are a number of boundaries or barriers that circumscribe and sometimes prevent the expression of agency" (p.262).

Lehmann's (2005) study also concludes that young people's decisions to go into trade apprenticeships reflect "independent choices infused with agency, even though these choices are situated in a context of habitus, cultural capital, and class" (p.345).

Figure 1. *Graphical representation of thematic factors that influence students' decision making concerning their education.*



Family background. An individual cannot be isolated from the social and cultural context in which he/she has developed. In terms of an individual's predisposition towards the study of the more academic general technology or towards a more practical vocational technology, it is interesting to explore how much the family background of the five students in these case studies has impacted on their subject choices within technology education. Analysing each case individually illustrates how each young person has taken on a habitus from home, whether their upbringing has placed more value on practical skills or academic skills, which correlates to the type of educational pathway they have followed in school.

It can be assumed that parents will want the best for their children. However what the reality of that 'best' is, depends to a large degree on the experience and

cultural capital of the family. Similar studies internationally (e.g. Dalley-Trim et al., 2008; Taylor, 2008; Lehmann, 2005; Evans, 2002) have revealed that young people show a marked tendency to follow in their parents' footsteps when making choices as to what subjects they feel comfortable taking and the career paths they pursue. It gives credence to Bourdieu's (1977) thesis that the systems that work towards forming a student's habitus are socially and culturally reproductive. Taylor's (2008) study shows that; "Students from families with higher parental education had made more active choices and had longer horizons for action and higher aspirations" (p. 400).

In this study Chester describes himself as coming from a 'working class' background. His father is a mechanic and his grandparents were also employed in working class vocations. Even though he contemplated going to university whilst in his final years of secondary school and he appears to have the academic ability and the persevering, self disciplined and self-motivated nature to succeed at that level of education, all the choices he made about his education reflected his social capital and habitus. He chose practical vocational subjects at school that reflected his upbringing, and his career pathway has been identical to his father's. The fact that he 'contemplated' university reflects the findings from Evan's (2002) study that showed students believe they have agency and some sense of self-determination in the choices they make but their agency is compromised by a number of structural boundaries.

> Young adults do manifest agentic beliefs in relation to work and their social environment, but encounter frustrations in expressing or acting on them (Evans, 2002, p. 265).

The analysis of the data in this study seems to indicate that decisions made that take young people outside their zone of experience and outside the zone of their parents' experience will be the harder to make.

Hemi admitted he was scared of studying at university in spite of the encouragement and support he received from his school. No one in his family has studied at university, so consequently he felt he would lack support and advice. Indeed both Hemi's parents and all his older brothers are involved in manual labour. The decision to follow a pathway outside the safe confines of his cultural capital is made even more difficult for Hemi because of the strength of his identification with Maori culture. His mother sees him struggling between the Maori ethic of loyalty to his family, staying at home to help on the farm and look

after his younger siblings and his desire to better himself and live up to the expectations and encouragement he received when he was at school. Even though he went to a very supportive school where Maori kaupapa (Maori culture and protocols) is extremely strong and valued, as his mother points out (supported by Vlaardingerbroek, 2005), the education system as a whole has not served Maori particularly well. The Maori Principal and teachers of the school could be described as having been acculturated into the value of academic education as a means to better oneself and better the collective lot of Maori in general, in much the same way as Bourdieu and Passeron (1990) describe how the middle classes value success in academic education. Hemi was torn between the school's expectations and desire for him to go on to university and his own insecurity about doing something beyond the scope of his experience and cultural capital.

Recently, Hemi has started attending an introductory course offered by the Maori tertiary institution 'Te Wananga o Aotearoa' to prepare students for entry into police training college. His mother says she can offer him support with 'encouraging words' and she feels that Hemi needs a supportive environment around him to keep himself motivated. However, she says it is up to him to persevere and do the work. On the face of it, family support is there for Hemi, but his mother voices her underlying expectation of failure when she says 'do the Maori thing and just give up'. This statement reflects the strength of influence the social and cultural capital of being a working class Maori has on Hemi's transition into working life.

Taylor's (2008) study of a carpentry apprenticeship programme in Canada and Lehmann's (2005) study of school to work transitions of German and Canadian youth, both suggest that students who have grown up in homes where manual skills are valued and parents involve their children in home or farm maintenance, building or renovation projects are more likely to gravitate towards vocational education pathways in school. Both Chester and Hemi's cases reflect a similar predisposition. However, this theme is particularly evident in Lorenzo's case where, despite displaying the experimentative, inquisitive qualities as a child that may have predisposed him to a more academic educational pathway, he ended up following a vocational pathway at school. Lorenzo describes himself as having wanted to be a builder ever since he started school. Yet both he and his father say that his real career aspiration has been to be a helicopter pilot. Lorenzo comes from a family background that values practical knowledge and

skills. The experiences he had helping his father build and renovate when he was growing up and the fact that his father had been a carpenter himself, all made the choice to try and get an apprenticeship when he left school so much easier for him. However, his transition into the workforce has not been smooth; he has failed to secure a formal apprenticeship and appears to jump from one low skilled job to another within a relatively short time frame. As described in the literature (e.g. Tufnell et al., 2002; Masdonati et al., 2010) to some degree this is likely to be a result of the difficult economic environment and firms' unwillingness to take on and invest in the training of new apprentices. However in Lorenzo's case it seems there is also an element of him not feeling challenged and motivated enough doing solely manual labour. He describes liking an intellectual challenge and one agentic decision he made outside his habitus was to take physics in Year 12. However, he rationalised this choice not because of the intellectual challenge, but because it might help him gain entry into the Airforce where he could get his helicopter pilot's license. In the end, he did not complete the full year of the physics course, saying even though he knew it would be good to have for his flying, he felt like it was not really relevant to his real world and life experience.

> "Woodworking is my Dad and I kinda had something to relate to, but physics not so much it's just a subject that you need."

Taking physics was the harder option, the option that would have meant breaking out of his habitus and going beyond what he was familiar and comfortable with. Lorenzo's transition into the workforce illustrates Winch and Clarke's (2003) concerns over an education system that brings about a low-skilled, low productivity economy in that he has jumped from one low-skilled job to another without any real commitment or security. He still aspires to save enough money to study for his helicopter pilot license but with a wife and young family to support and no formal trade qualification to fall back on, his options are very limited.

Teese and Polesel (2003) suggest in their discussion of ways to democratise access to the curriculum, that; "the barriers to improved learning in upper secondary school include the barriers to effective learning in universities themselves" (p. 227). A goal justifying the introduction of senior general technology education was to provide the opportunity for students with a practical background to achieve success in the traditional academic structure of the curriculum. However, the barriers Teese and Polesel (2003) describe above

relate to the broader academic curriculum and have impacted particularly on the young people from working class backgrounds. Darcana, whose parents are not tertiary trained and have practical jobs, still wants to go to university. He chose an academic pathway at school and enrolled in an engineering degree when he graduated from Year 13. However, he withdrew from his studies because he did not have the prerequisite Level 3 mathematics qualifications and was struggling with the bridging course the university had required him to complete. Darcana's upbringing exposed him to a variety of practical, 'making and doing' skills. Yet Darcana was the student who chose to take the more academic general materials technology all the way through to Year 13. He is the one who talks about answering the 'why' questions, was uncomfortable using workshop machinery and needed help with the practical realisation of his design ideas. He appears to have the motivation and desire to pursue his educational and career aspirations. He also has the support and encouragement of his mother. However as Teese and Polesel (2003) suggest, the structure and pedagogy of the traditional academic curriculum (in particular the mathematics curriculum) has basically worked to exclude him from following this pathway. Similarly the structure of the physics curriculum appears to have worked against Lorenzo; failing to engage him and keep him interested enough to complete the course. Chester's lack of interest and achievement in English seemed to be a contributing factor in his abandoning the idea of a university education, as it was the only 'academic' subject that he describes having difficulty with. In these cases it seems that the structural barriers of the academic curriculum have, to various degrees, disadvantaged the young people from working class backgrounds and frustrated any sense of self-determination they may feel.

Polesel (2008) describes vocational education in Australia as being "heavily concentrated in schools serving working-class communities" (p. 621) and Dalley-Trim et al. (2008) report that Australian secondary school vocational education programmes are attracting students from low socio-economic backgrounds whose parents do not have a tertiary education and/or reside in rural areas. Similarly, the young people from working class backgrounds involved in these case studies were attracted to the vocational programmes offered by their schools as a programme of study they felt comfortable pursuing and reflected their cultural capital and habitus. Hemi describes liking the security of a step by step approach to teaching in the vocational classes, where everything is spelled out very prescriptively and he can follow that process and work things out in that

way. He describes always asking the teacher if he did not know how to do something. He chose vocational courses because they were 'hands-on', within his cultural habitus and an 'easy' way of gaining his NCEA qualifications. However, he was less enthusiastic about actually transitioning into a trade apprenticeship because of the perception that the trades did not have the same status as university study.

Chester's father perceives him as more artistic and good with his hands in a creative way rather than a technical way. Yet Chester chose to go down the vocational path, rationalising his decision in terms of what he felt he enjoyed, and was good at. He says he did not choose general technology because he felt there was too much emphasis on classroom based design and drawing and not enough emphasis on practical workshop skills. Chester's case echoes the rationalisation category described by Lehmann (2005) of "biography construction that reaffirmed habitual states and earlier decisions" (p.338). He rejected the idea of taking the design based general technology course because it was too difficult and "didn't really suit me" as he seemed to see himself as a "practical kid". However his rationalisation starts to break down as he describes what students did in the general technology class; the planning, designing, "nutting it all out", then going in to the workshop to make it. He reflects that this approach may actually be better than just being told what to do and how to do it by the vocational technology teacher. Perhaps with the benefit of hindsight, and a more mature outlook, Chester feels this approach may have suited his abilities after all. Even so, it does not diminish the validity and usefulness of the learning occurring in vocational classes, and Chester certainly states he does not regret taking the classes he did.

Although Lorenzo's school did not offer general materials technology as a specific subject beyond the compulsory years of schooling, Lorenzo did take graphics at Year 11. The focus and aims of this course are aligned with the aims of general technology with students working through a project and enquiry based design process, critical analysis and problem solving. Lorenzo chose not to continue this subject in Year 12, but to focus on the vocational technology carpentry programme that reaffirmed his decision to be a carpenter but did not necessarily challenge his intellectual and creative ability.

The one student from the five case studies that has successfully transitioned into university study is Emma. She has exceptional academic ability and was dux of

her secondary school in her final year there. Her parents are not university educated. They are entrepreneurial, and their values and aspirations appear reflected in Emma's own aims for her studies. She chose an academic pathway at school but chose subjects equally for the academic grades she could achieve, and for her interests and abilities. Her choice of subjects appears very calculated in terms of gaining university entrance and scholarships. Emma's mother acknowledges the role she and her husband played in guiding Emma to make the 'right' choices that would suit her and allow her the greatest opportunity for success. Emma's mother also acknowledges the influence her school teachers had on the subject choices she made and the pathway she followed. However in the end, Emma's goal in her education, from when she first started secondary school, has been to start her own business. This again reflects, in exactly the same way as the other cases, the importance of social and cultural habitus of her parents and the skills that were implicitly valued in Emma's upbringing.

All the students in the five case studies described above, made choices that reflect their cultural capital and the habitus they have developed. Emma's parents value entrepreneurship; they have run their own business. Consequently Emma has always wanted to start her own business and took some subjects at school; Maths, English, and Accounting (even when she had to study it by correspondence as the school could not offer a formal class) that reflected that habitus. Lorenzo's father was a carpenter and Lorenzo grew up helping him in his work. Chester also had an upbringing that valued trades employment and working with your hands. Both young men, even though they had the ability to go down an academic pathway and change their habitus through changing the choices they made in their education, chose the option that reflected their upbringing and carried through the cultural capital they had inherited from their family background. This option was therefore, to them, the 'easier' option. Hemi's mother actually voices the difficulty that children face developing beyond their inherited habitus, when she describes Hemi being torn between 'family loyalty' and 'bettering himself'. The dilemma for Hemi is even greater because of the strength of his cultural identity as a Maori and the expectations on his behaviour that that brings, and the expectations and encouragement he received from his school to carry the mantle of his tribe and the mana of his ancestry into academic success.

In spite of a systemic perception that academic pathways are more valuable or desirable and consequently the first option for those that are able, these

students, even when they had academic capability, followed pathways that reflected their family background and upbringing. However, making the choice between whether or not to follow an academic or vocational education pathway does not solely depend on the relative stigma attached to each. To further explore other factors where young people may be expressing their own agency and self-determination in the decisions they make about their education the next section will focus on economic issues.

Financial considerations. Lehmann (2005) describes 'rational choice' theory where "people attempt to maximise the utility of their educational decisions based on costs, expected benefits, and the probability of success of various alternatives" (p. 330). Analysing these case studies in terms of rational choice theory, it can be argued that the young people are using self determination to make rational, agentic decisions based on a cost/benefit analysis of different educational and career pathways. Their choices take into account the relative wealth of their families and the families' ability to fund tertiary education, the opportunity cost of going straight into the workforce and immediately earning a wage. In an environment where the media reports shortages of skilled trades people and promotional literature from both Industry Training Organisations and the armed forces stress the financial benefits of doing vocational training or going into the services, it is not surprising that students from lower socio-economic, working class backgrounds are attracted to following these pathways. However, with the difficult economic environment at present, businesses are unwilling to invest in training new staff (Masdonati et al., 2010). Consequently, the responsibility falls to schools to instil appropriate initial skills and knowledge in students so that they can successfully transition into the workforce or further tertiary level training.

Looking specifically at the young people involved in the case studies presented in this research; Hemi worries that tertiary education is a costly exercise that neither he, nor his family have the disposable income to afford. He perceives that vocational education offers him a much better cost/benefit ratio. Training in a trade is a relatively safe and secure option to gain a career with a good income compared to the insecurity of finding a job after graduating from university with a degree, but also with a large student loan. Chester initially had thought to go to university to become a lawyer but then changed his mind and decided to go into the Airforce. His father had encouraged him in this idea because in the Airforce he would be paid to receive vocational training rather than going into debt with a

student loan. Lorenzo also had thought to go into the Airforce to gain his helicopter pilot's license but did not apply, justifying the decision through fear of failing the initial health check. He is now faced with the difficult task of saving enough money to fund his own private helicopter pilots training.

At first glance Hemi, Chester and Lorenzo's narratives appear to be consistent with rational choice theory. However, the theory implies a conscious, pragmatic weighing up of the pros and cons to make objective decisions. Although Chester's father describes Chester as 'weighing up all the options and then making up his own mind,' both he and Chester also say that Chester just slowly 'went off' the idea of going to university and then again, joining the Airforce. All three young people appear to have followed 'a path of least resistance' in their school to work transitions that reflect their habitus, cultural and social capital.

Emma worked hard at school, made all the right pragmatic subject choices to optimise her chances of gaining good academic results and scholarships to allow her to fund her university study. Her parents are relatively well educated and successful and, as in the well educated families of Taylor's (2008) study, have high aspirations for their children and widest horizons for action. They chose to send Emma to her small low socio-economic decile, strongly supportive and community based school even though it was not their local school. Emma has benefited greatly from that particular schooling system and the relatively informal structure it operates under. Through her hard work and ability she was able to shine, where in another larger school as her mother says, she may have 'got lost' and not had access to the same opportunities as she has had. Emma's high degree of self-discipline, motivation and family support has consequently led to the institutional structure of her low socio-economic school, acting in her favour rather than being as Teese and Polesel (2003) suggest, a limiting factor in her success.

Chester's teacher believes one of the reasons that students are staying on longer at school is that there are very few jobs available to school leavers in the current economic climate. He believes the school's vocational programmes are a useful tool for students to engage in education that will prove valuable in helping them transition into work. This plays interestingly into Teese and Polesel's (2003) thesis where they suggest there is a trend towards more economic reliance on the education system to provide access to employment. They describe that during the latter part of last century more and more professional jobs have

required university qualifications and the economic recessions (as we are seeing now) have also impacted on apprenticeship commencements favouring individuals with better school results. This has caused students to stay on at school longer even if they are not achieving well; “economic insecurity is postponed rather than relieved by student achievement” (Teese &Polesel, 2003, p. 11). Certainly, Hemi stayed on as long as he could at school, felt engaged and supported in his schooling and achieved all his NCEA qualifications through doing vocational type programmes. In spite of this apparent success he failed to transition successfully into employment. Both he and his mother attribute this to employers looking for workers with experience who can be productive straight away rather than having to invest in their training. This is consistent with the findings of Tufnell et al. (2002), Masdonati et al. (2010) and Winch and Clarke (2003), and reflects the difficult economic environment at present that influences businesses’ decisions to train new staff.

Both Chester’s father’s observation that school leavers are being used as cheap labour with the promise of starting an apprenticeship that never eventuates, and Lorenzo’s case and working history since he left school, are consistent with Marks’ (2005) description of Australia’s youth labour market. They also give credence to the fears Winch and Clarke (2003) voice over vocational education policy leading to a low skilled, low productivity economy. Winch and Clarke (2003) explain the presumption that individuals will have to undertake multiple periods of learning as they move from one job to the next in a relatively low skilled context, leads to industry not needing or wanting to invest in training a high skilled work force. Instead it leads to industry training new staff just well enough to do specific job related tasks. This in turn leads to employees having no sense of loyalty to their employers as evidenced by Lorenzo’s constant changing of his relatively low-skilled jobs.

Whether through pragmatic monetary considerations, or structural pressure to follow the more highly valued academic pathway, rather than these young peoples’ individual agency determining the decisions they made about their educational and career pathways, the predominant influence appears to be that of inherited cultural capital.

School context. Students’ choices are not just bounded by their family background and upbringing. Another large influence is the environmental context in which they did their schooling; the physical location of their school, the type of

community their school serves, its socio-economic decile status, the background of the school's management and teachers. All these factors have bearing on the type of programmes valued and offered by the school to its students and consequently, the choices students make as they progress through their secondary schooling. They will be discussed in more detail in this section.

The physical location (whether the school serves a rural or urban community), and the socio-economic standing of that community has bearing on the needs and expectations the students and the community they come from, have of the type of technology education programmes the school offers. As discussed above, students will bring prior knowledge, skills and values they have inherited from home with them to school as cultural capital. School management try and cater to their student clientele by providing programmes of study that they perceive meet the needs of their students and the expectations of the school community. This results in the situation described by Polesel (2008) and Dalley-Trim et al. (2008) in Australia, where vocational training programmes tend to be concentrated in low socio-economic and rural schools, and is supported by comments made by the teachers involved in this research. Two of the schools are located in relatively lower socio-economic areas. The third, although it has a higher socio-economic decile rating, serves a provincial community involved in farming and rural servicing. The technology teachers at these schools all said they provide vocational technology courses because it serves the needs of their community and it is what their students want and expect to learn. Chester's teacher describes the investigation he did in designing the school's new technology buildings and workshops. He says the technology classes and facilities he saw in a high socio-economic school in a large urban centre where students have parents who work in professional 'white collar' jobs, necessarily have a completely different focus to the classes and facilities required by his school that serves a more rural community. Darcana's teacher comments that his school serves an industrial, working class community because of the low socio-economic area in which it is located. Consequently he describes a greater uptake of students doing vocational programmes compared to general technology programmes.

Technology teachers themselves come with their own habitus and cultural capital. If they entered teaching from a trade's background, they are more likely to value and promote vocational programmes and pathways (Bowskill et al. 2011). Hemi and Lorenzo's teacher (a carpenter by trade), criticises the general

technology curriculum because he perceives it as not as ‘hands-on’ as he would like. He explains that only a very small percentage of the low socio-economic decile school’s graduates go on to university. Both he and the rest of the school’s management team see the vocational programmes the school offers as often the only way many of their under-privileged students, who are often struggling with basic literacy and numeracy, can realistically achieve their NCEA qualifications. If, as in this case, school management values vocational programmes as a place where ‘difficult’ students can gain credits and qualifications, then they are more likely to encourage delivery of those programmes over the perceived more academically challenging senior general technology programmes. Students displaying academic ability by achieving early success in the mainstream schooling system are much more likely to be directed into traditional academically focussed subjects like mathematics and the sciences as they progress into senior secondary school. The vocational technology pathways are perceived as valuable for both the less academically able students themselves but also benefit the school by improving overall pass rates. The pass rates are reported in national league tables and can help promote the school and increase student enrolment.

Schools’ management teams may value more highly either the instrumentalist or liberal paradigms of education. These different philosophical approaches to education will influence and underpin the type of technology education programmes that are offered in their schools. However, the concept of providing all students a generalist education at senior secondary school level is complicated by schools own specialist subject based structure. Even if management wish to encourage academic general technology education in their senior school, structural issues such as the size of the school, staffing, timetabling and budget, may make it impossible to do so.

Darcana’s and Chester’s larger schools appear to be faced with the structural and managerial problem of offering many students a choice of many different specialist subjects and then having to match them all with a limited number of teachers in a fixed timetable structure. Chester’s teacher describes having to drop an integrated junior, general technology programme that valued and delivered the generalist approach the new curriculum describes, because of pressure from management over timetabling issues. They have now reverted back to the more vocational, manual skills based approach that they traditionally followed because even though general technology is a compulsory part of the

junior curriculum, their junior technology programmes have now become optional for students to take. Consequently Chester's teacher describes students who come to school with intellectual ability and habitus choosing languages, and students with practical ability, technology. Overall this has had the effect of firstly; decreasing the pool of academically able students who would be more likely to choose and do well in senior level general technology courses, and secondly; leading schools' technology departments to focus on vocational training pathways that they perceive as more relevant to the needs and aspirations of their student clientele.

Hemi, Emma and Lorenzo's smaller school is confronted with the problem of a limited number of students (especially at senior secondary level), and a limited number of teachers to be able to viably offer students choices of what classes they can take. If there are only one or two students who choose to take a certain subject (like Emma choosing accounting) they are forced to take the subject by correspondence. The type of programmes offered in technology education in all the schools of this study are decided conjointly by the philosophical stance of school management, by student demand for particular programmes and by the personal preferences, skills and qualifications of the technology teachers.

Subject specialisation. Students are confronted with the dilemma of specialisation early in their secondary schooling, when many are still undecided on what career they would like to pursue and are often interested in a wider range of subjects than their timetable will permit them to take. Practically, all the students in these cases have, to some degree, been limited in their agency by the structures of the school timetable. Hemi felt he enjoyed 'everything and anything' at school and was only restricted by the limitations of his timetable and the structure of the school day. Even though Darcana always had a clear idea of what he wanted to do when he left school, his mother talks of him being unable to take Spanish (which he was interested in) and also accounting and biology, which she thought he may have profited from, because of the school's structural timetabling issues. Chester's father also alludes to the very real dilemma of many, particularly male students who have no concrete idea of what they want to do when they leave school and are being pigeonholed into subject pathways very early in their secondary schooling.

Young (2010b) identifies this over-specialisation as a problem in a subject based curriculum. He asks how do students forced into early subject specialisation

“acquire the resources to ‘make connections’ and gain a sense of the world as a ‘whole’?” (p. 28). The concept of a generalist education described by Chester’s father where students are given the opportunity to keep as many options open as possible, is perhaps more an ideal than a reality. Interestingly, Chester’s father’s concept of ‘broadening peoples’ horizons’ at school goes in the direction of giving academic students the balance of practical subjects and experience that help develop a student’s fine motor skills, rather than focussing on giving practical students opportunities for academic success. Emma certainly values the practical experiences she had in her compulsory junior technology classes that otherwise she would not have elected to do. She says now she is not so shy to try and do a little home maintenance herself, cut a piece of wood or hammer a nail.

Sociocultural theory, where the role of community is acknowledged and valued in learning and students are taught in ways that will help them become positive contributors to particular communities, is evident in the outcomes of the young people described in these case studies. Young (2010b) seemingly critiques sociocultural theory when he suggests the fundamental purpose of schools is “to take pupils beyond their experience in ways that they would be unlikely to have access to at home” (p. 24). However, as society develops and changes ever more rapidly and different demands and expectations are placed on young people as they move into the labour market, education needs to respond appropriately to match the changing needs of communities and indeed, take students beyond the experiences to which their family background exposes them. The question arises as to whether this is achievable through the instrumentalist approach of using education as a tool for promoting economic growth by teaching specific skills deemed relevant to the needs of industry and students’ future employment. Equally, the traditional, positivist approach where curriculum knowledge is externally fixed, reflects the social and political power structures of society and learners have to comply to succeed, may not necessarily achieve this goal either. Young (2010b) suggests taking students beyond their ‘home experience’ in a ‘curriculum of engagement’ where they learn intellectual concepts, transferable knowledge and skills through practical, experiential project based learning that can be applied to both vocational and academic futures. As discussed in the ‘financial considerations’ section above, in the present economic climate there is a tendency for employers to want either ‘ready-made’ trained staff from training institutions, or workers with job experience behind them, or cheap

unskilled labour. Consequently as Winch and Clarke (2003) and Polesel (2010) suggest; it is incumbent on initial vocational training prior to actual employment, to provide students with skills, knowledge and judgement vital to supply a high-skill productive economy with skilled labour. Vocational education should focus on development of adaptable and transferable, occupational skills rather than job or task specific skills. In her thesis that technology education is an effective way of delivering vocational education in secondary schools, Pavlova (2009), recognising the changing socio-cultural context in which education occurs and the need to *grow* knowledge rather than *transfer* knowledge posited by sociocultural theory (Lim & Renshaw, 2001), describes technology education as "...a means for developing knowledge, skills, attitudes and values that allow students to maximise their flexibility and adaptability to their future employment" (p. 24).

To further explore these themes, the following section will look at the perceptions of the research participants as to firstly; what knowledge and skills are taught in both vocational and general technology education programmes, and secondly; which knowledge and skills have been most useful to them in transitioning from school into the workplace or tertiary study.

Technology Education Knowledge and Skills.

The section above discussed the influences on the choices young people make in their education that impact on their career pathways and their future lives after they leave compulsory secondary schooling. Vocational technology education has the reputation and perception of being focussed on teaching job related practical competencies needed to undertake specific careers in the trades. General technology education, on the other hand, is perceived as more academic, teaching process focussed, transferable general skills needed for negotiating the ever changing technological world and workplace. However, at present there is a reported shortage of skilled trade's people (e.g., Immigration New Zealand, 2011; NZIER, 2006; Department of Labour, 2005) and a high percentage of young school leavers are finding it difficult to find work. The analysis and discussion that follows, focuses on gaining a clearer picture of the value of the present vocational and general technology education secondary school programmes and how they differ in these five case studies. There will be discussion on whether or not there are points of conjunction in the skills and knowledge taught in vocational and general technology education, and whether

the points of difference are valuable and important to maintain as distinct pathways with different career outcomes.

Contextualised learning. In discussing the STEM subjects initiative (science, technology, engineering and mathematics) in Britain, Kimbell (2011) reflects that one of the problems with students accessing and engaging in science and mathematics at school is the fact that-

> ...maths and science are high status knowledge domains. This status insulates them from the need to make themselves interesting and meaningful...If students fail (or refuse to show any interest) then it's clearly something lacking on their part (Kimbell, 2011, p. 8).

Stevenson (2003) argues that all knowledge and learning is contextual and even the 'general' knowledge that academic education seeks to impart, has its own scholarly context and goals. As discussed previously, both Bourdieu and Passeron (1990) and Teese and Polesel (2003) argue that having high status academic subjects with their scholarly context and goals help perpetuate social structure and deny working-class students access to the curriculum. However, putting aside this argument the discussion that follows will explore how general and vocational technology education can help integrate 'general' scientific and mathematical concepts into student learning in an effective way. It has been argued that the educational aim to achieve direct transfer of 'general' knowledge and applying it to 'real world' situations is misdirected (Baartman & Gravemeijer, 2010; Stevenson, 2003). Understanding and meaning is constructed in a holistic sense through taking part in significant activity in a real context that students can relate to (Stevenson, 2005). In a report by the Centre for Education and Industry, University of Warwick (2009) technology education is described as having the potential to-

> ...draw out the applications of scientific and mathematical ideas...[to] produce better links between skills, abilities and types of career and be the bridge between academic study and real life activity. (p. 10)

Chester's experience of studying academic subjects at school is consistent with Stevenson's (2003) argument that general academic subjects have their own scholarly context. Chester describes only seeing relevance in studying these subjects if you know you want to go to University. Otherwise he says, there doesn't seem any point in doing them and practically minded students would ask

'why am I here doing this?' They do not see the relationship with what they want to do and what is being taught in a lot of their subjects. Lorenzo and Hemi's teacher suggests a reason for the maintenance of academic subjects existing in their own scholarly context separate from the 'real world', is that teachers of those subjects may well have gone through school, gone straight to university and then come straight back to school again. They will never have had what he terms as, 'industry experience'. In contrast he says technology teachers, because many do have that industry experience, can make their subject relevant to the 'real world' and 'real' experience. He sees students having difficulty perceiving the links between some maths and english work they do and the real world of their own experience. Consequently, as Chester describes above, they do not really understand it, or the reasons why they have to do it. Lorenzo and Hemi's teacher describes his vocational technology teaching as making those links with other subjects explicit for students, giving them real world contexts to apply knowledge from other subjects and consequently make sense of *all* their education.

As encouragement for the thesis that general technology education also can be a bridge, "the integrator, the sense-maker, the interest-provider" (Kimbell, 2011, p.8) for traditional academic subjects, Chester describes his Year 10 biotechnology/horticulture class as being much more enjoyable because it achieved a nice balance between "a little bit of science, a little bit of theory and a little bit of practical." However, in his senior secondary schooling, Chester went down the vocational technology pathway. He describes the 'theory' component of those classes as directly linked to the specific knowledge and skills required in the context of completing practical tasks. There appears to be very little focus on delivery of broader general scientific concepts that may have been more apparent in his biotechnology/horticulture class. Understanding and meaning constructed in the vocational classes was directly linked to doing the practical tasks in context of the school workshops. He said having this real context for the theoretical knowledge was important especially for the 'practical minded' students in his class; "some of the books are real hard to get your head around... then you see it working and you've got it in your hands and that's easy as!" This is consistent with the findings presented by Bjurulf (2010), in a case study of one student in the Swedish 'Apprentice Project'. Bjurulf (2010) describes a situation in which vocational technology education is delivered using both teacher led and student led approaches to teaching and learning, providing opportunities for

students to develop both practical work related knowledge and skills, and key competencies that will both help transition students successfully into employment. She describes a 'hands on' boy who feels he gains relevant basic knowledge at school where "the teacher is a model, showing how to do things…" and then in the workplace he is left to his own devices to apply that knowledge. He sees his supervisor in the workplace acting more as a "…backup or sounding board" (Bjurulf, 2010, p. 62). The two different contexts of school and the workplace provide two different approaches to the subject's learning but both contribute to a more holistic, dual context system of learning. Bjurulf (2010) states that-

> ...to fully develop employability skills, there is a need of basic knowledge obtained from school, this basic knowledge may constitute the foundation for the pupils to be able to apply their skills in a different environment (Bjurulf, 2010, p. 62).

Although the practical context for Chester was the school workshop rather than actual workplace placement, Chester feels 'learning his way around a workshop' at school really set him up for when he did get his workshop apprenticeship. This is a view also shared by participants in Dalley-Trim et al.'s (2008) Australian study of secondary school VET. Lorenzo and Hemi's carpentry teacher tries to provide his students a context for their learning as close to the real world of the workplace as possible by continuing to run his private building business alongside his school work. Consequently, he is able to provide his students work experience through that business. Woods (2008) points out the benefits of this approach saying that in terms of speed of transition into the workforce "the most rapid and successful outcomes are gained from VET programs linked to the workplace" (p. 472).

Hemi reinforces the direct link between the theory and practical, saying "the practical side helped you remember and recall things for the theory". Interestingly, in terms of transfer of knowledge between theory and practice, Hemi describes having to copy out the theory from books and not really registering what it said. He then did the practical and was only able to make sense of the theory through having done the practical. Both Hemi and his mother suggest the predilection for studying 'practical, then academic' rather than the other way around is culturally bounded in his being a Maori. However Hemi's experience is completely consistent with the experience of Chester making sense

of his theory books (described above). Chester was born in Britain to English parents. Rather than culturally bounded, the need to contextualise learning is common to all. Bjurulf (2010) describes having theory and practice interwoven in teaching and the contextualisation of learning tasks provides a more holistic approach to education. Hemi's mother expresses the same desire to see schools find a good holistic balance between teaching what she terms, "academic" and "practical" as "you can't have one without the other".

Darcana describes the difficulty he has with mathematics and relating and understanding decontextualised general academic concepts as the "logical side", that is "more detached…not real…all in your head…existing in a dimension we can't exist in…it just doesn't make the same sense." He describes needing a physical reason or application to actually engage in the learning activity, and then he had no problem working things out even when they involved physics or mathematical knowledge. Also in examination situations he felt he could not recall knowledge without some sort of link to contextualise the knowledge with something tangible. Darcana believes that education should be about making conceptual knowledge more accessible to students by making links between that type of knowledge and the real world that students can relate to. He is derisive of a mainstream maths class where the teacher admitted the only time they would ever use the mathematical concept they were learning was if they became maths teachers themselves. On the other hand he is full of praise for a vocational technology programme that gave students struggling with mainstream education basic literacy and numeracy skills by delivering them in a vocational context that they could relate to. Darcana's teacher also sees the vocational technology programme as a valuable educational tool because it can be tailored to meet the needs of these students.

Darcana's experiences and observations reinforce the importance of contextualised learning described in the literature (e.g., Stevenson, 2003; Stevenson, 2005; Bjurulf, 2010). Darcana describes himself as both an academic and practical student. He engaged in, benefited from and succeeded in the senior general technology programme he undertook in the context of real world, project based learning. Emma took general technology in the subject context of graphics and similarly undertook project based learning in real world contexts. They both describe transferring and using knowledge and skills from other subjects, researching when they did not know something, and using conceptual knowledge from maths and science in the process of completing their

projects. Emma says of her consideration of costings and the economics of her designs; “[I] guess it was kinda like the real life application of maths.” Darcana and Emma’s positive experience of general technology provides evidence that for these two students, who have aspirations to go on to tertiary study, benefited by engaging in the contextualised project based approach of general technology. The ‘real world’ contexts of their projects provided opportunity to apply in a meaningful way, theoretic knowledge from other subject areas as well as learning ‘key competencies’ and ‘life skills’.

With vocational technology, all the participants and their teachers describe the usefulness and success it is having as a way to engage non-academic students in education. General skills of literacy and numeracy (along with trade specific specialist knowledge and skills) can be taught to give students more opportunity for successful transition into the workforce. Students who take vocational technology courses (no matter the underlying reason: whether it be structural or agentic), generally aspire to a trade vocation. Trade vocations, with the technological advancement of materials, tools and techniques are far from being routine, solely requiring mechanistic action on repetitive tasks. Trades people will need to transfer their knowledge and skills to different contexts and situations they meet in the workplace and will consequently need to be taught in a way that gives them this ability. Contextualised learning experiences that reflect real world experience and intertwine theory and practical appear an effective way to proceed whether in the context of vocational or general technology education.

Theoretical and practical balance. Within technology education in New Zealand, vocational technology courses and assessment criteria are perceived as emphasising the development of practical capability and skills. General technology courses and assessment criteria, on the other hand are perceived as emphasising more the understanding and application of theoretical concepts in design and technological practice. Analysing the findings from these five case studies, we can explore the perceptions held by the participants around the theoretical and practical components of technology studies, what the students valued and enjoyed about each and how that relates to the literature.

The 2007 New Zealand Curriculum (NZC) document outlines a set of conceptual skills and competencies for students to learn and grade level descriptors that describe how students’ understanding of these concepts should develop as they progress through their secondary schooling. These skills and competencies are

structured and presented in terms of 'achievement objectives'. They are all academically based. There are no achievement objectives that define the manual or practical skills students should be achieving at each curriculum level. In order for senior level general technology students to provide evidence for assessment so that examiners can gauge whether they are working at the appropriate curriculum level, their teachers have required them to write extensively, describing their research, evaluative commentary and justification of their designs. All the teachers interviewed in these case studies describe this emphasis on writing resulting in a decline in the popularity of the senior general materials technology to a point where many schools do not offer it as an option to their students any more. As Chester's teacher described, students do not see the point of doing a lot of research just for the sake of doing research. He gives the example of researching alternative materials for their sail board project when it's obvious what material is going to be best.

Whether or not this emphasis on writing and the way teachers are getting their students to document assessment evidence is a result of guidance and recommendation from the NZQA markers, Ministry of Education subject advisors, or the subject teachers themselves is unclear. However, Darcana's teacher (who's school is the only one of the schools in this study still offering core technology right through to Year 13), describes a pedagogical strategy he employs to help his students provide evidence of their understanding of the concepts described in the achievement objectives. He suggests students draw or sketch what they have done and annotate the drawing with a couple of short notes instead of writing lengthy descriptions. He sees this strategy working to keep his predominantly 'hands-on' students engaged in their work, without overburdening them with paper work.

Many students take technology subjects because they want to do something practical with their hands rather than, in Chester's words "having a pen and paper in front of me." All the students in these case studies expressed an interest in the hands-on element of their technology studies. Even Emma, who is a very capable academic student, took graphics and art because she enjoyed that creative side and it provided an opportunity for her to express her artistic skill. This finding is echoed in the findings of Dalley-Trim et al. (2008) in Australia, where they describe one of the factors that influence students' choosing school based vocational subjects, was their perception that those subjects are the 'fun'

ones. This is as opposed to the traditional academic subjects that are perceived as the 'boring' ones.

In New Zealand's 2007 curriculum and latest assessment structure for senior secondary school, the subject of graphics has been subsumed into the broader technology curriculum and renamed 'Design and Visual Communication'. Graphics has always had a higher academic status than the traditional craft subjects offered by school's technology departments. None of the teachers in these case studies have seen the same decline in popularity of senior graphics classes as they have for senior general technology materials classes. However, Chester's teacher (who also teaches graphics), said that he has had to change his pedagogical approach to teaching graphics now that it is more process focussed and project based. He explains there is a lot less focus on teaching the whole class subject specific knowledge and skill techniques. He is now showing individual students drawing techniques on a 'need to know' basis for them to successfully complete their projects. Consequently there is less of an emphasis on the 'how to' and more on the transferable knowledge and skills underpinning student learning; recognition of what the techniques are, when they are needed and where to find out how to do them. Emma's teacher also says he tries to get his students to focus more on the application of the specific graphic's knowledge and skills taught in class. He appears to scaffold the development of his students by initially setting projects that have quite tightly defined boundaries and specifications that necessitate learning specific knowledge and skills. The students can then use and apply the knowledge and skills to tasks they identify they need to complete in their more independently driven projects later in Year 12 and Year 13. Allan (2007) explains that, in the context of linking theory and practice in project based learning "...making particular skills meaningful and demonstrating their usefulness remain linked to the theory underpinning the doing, regardless of the performance emphasis of the competency framework" (p. 89).

Before students can apply particular task related skills usefully though, they need to have a degree of competency in performing those tasks. Vocational technology education achieves this competency through students all undertaking exactly the same learning task modelled by the teacher. As Chester explains his vocational teacher would show the class what to do and then they would go off and try and do it themselves. General technology education in contrast, hopes students will achieve competency in the process of application of the task related

skill in the context of their individualised project. The very self-motivated and academically capable Emma is a case illustrating the success of this model. She looks back at the projects she completed in her graphics classes and can see how she progressively gained knowledge, skills and confidence. She can see the learning that occurred now but was not aware of the learning at the time.

All of the teachers involved in these case studies are using junior general technology classes to give students basic manual competencies that will set them up for whichever technology educational pathway they may choose to follow in senior school. Lorenzo and Hemi's teacher talks about finding a 'balance' between satisfying the Ministry of Education curriculum requirements, and giving students adequate practical competencies to enable them to be successful in their later studies. Darcana's teacher also describes keeping the practical skills that they have always done in the craft based curriculum and just adding on the new academic curriculum requirements. Hemi obviously recognised this strategy when he explained that he felt there was a continuity of teaching style and content of the junior technology and the senior vocational technology courses he did. He made the observation that you have to learn the 'basics' when you are young before you can progress into the senior level.

Looking back on his secondary school education, Lorenzo feels he enjoyed more and gained more of a sense of accomplishment from his graphics general technology class because it was more of a challenge. He compares the learning process as more reflective of what you have to do in the real world, where you cannot just 'copy off your mate' but have to 'think about your own thing'. In a similar way Emma compares her vocational technology computing class with her general technology graphics class and says graphics was more about "how to think about a project not just how to do something". She felt the computer course was very prescriptive, "step by step...no variation from the path...wasn't like the whole project was yours...computers wasn't higher level learning." Hemi however, loved the prescriptive nature of the computer class because he knew exactly what was expected and what he had to do to achieve. Darcana saw his general materials technology class as more challenging than the vocational classes because he was not told exactly how to make his project, if he ran into problems he would have to work out himself how to fix them. Although he enjoyed documenting the process he took completing his project, Darcana said that only about one third of the work involved practical and the other two thirds written. As discussed above this emphasis on writing has put many students off

the general materials technology classes because they expect the focus to be more on the practical. Whereas in graphics with its longer more academic tradition, students are more aware of the written analysis element of the course before they choose it as an option.

What emerges from this analysis and discussion, relates directly back to the discussion above on providing meaningful, practical contexts for students to learn and make sense of theoretical concepts. Learning can be made more engaging for a wide variety of students and more democratic access to the curriculum can be achieved through technology education's practical, project based learning. As Allan (2007) suggests; "The dualism [between theory and practice] hides the way people learn, who learns and what knowledge is developed" (p. 90).

Similarly Bjurulf (2010) suggests that "theory and practice need to be interwoven in order to help learners to acquire holistic learning" (p. 59). Through both vocational and general technology education, students can learn the theory underpinning the doing by making knowledge meaningful in practical application. Some students find the challenge of individualised projects in general technology more engaging. They enjoy the process of documenting and explaining their work and the process they undertook to achieve it. Other students find vocational technology's more prescriptive standardised practical projects and the associated theoretical learning more suited to their learning style. As discussed above, the cultural capital a student brings from home, the value their family places on intellectual enquiry as opposed to manual capability have influence on the subject choices they make at school and their aspirations about what they want to do when they leave school (e.g., Taylor, 2008; Teese & Polesel, 2003; Bourdieu & Passeron, 1990). The teachers from all five case studies say most students who choose to study technology education are choosing the vocational pathway because they want to be trades people. It could be said that these students are more concerned with learning the 'how to' than to fully understanding the 'why'. Advocates of a general education would say that it is still incumbent on teachers to teach these students the theoretical knowledge, scientific and mathematical principles that underpin why the natural world works in the way it does. In doing this, it could be argued that they are providing students with the theoretical understanding underpinning the 'how to'. However, it could also be argued that they will be just as employable, competent in their employment and fulfilled in their lives without that knowledge. To explore what skills are fundamental in achieving these particular goals the discussion will now

look at how key competencies and life skills were delivered in the technology education of the students in the five cases.

Key competencies and life skills in technology education. Each of the students in these case studies have different personalities, preferences and skill sets that they brought to their technology studies. These personal qualities have influenced the choice of subjects they took at secondary school and the pathways they have followed post secondary school. Literature suggests (e.g., Pavlova, 2009; Stevenson, 2003; Winch & Clarke, 2003) the skills and knowledge needed for employment in the future world of work are becoming more and more the general transferable skills needed for life. Technology education is seen as an effective means to develop students' personal qualities and prepare them for future employment. This being the case, the discussion that follows will explore how each of the personal qualities of the students in these case studies have been recognised and developed in their technology education, and what knowledge and skills the students perceive as most valuable in their lives since graduating secondary school.

Cooperative skills. Darcana felt uncomfortable and unsure about using workshop machinery but enjoyed the design process and the documentation of that process. One of the key competencies that the NZC describes should be taught across all the subject curricula, is cooperation and social skills. In Tufnell et al.'s (2002) research into the skills employers are looking for, these skills are the ones most highly prioritised. Darcana describes asking his classmates in the vocational technology courses, who were more proficient and comfortable with using the machines to help him when he needed it. Similarly, Hemi describes taking part in a BCITO competition, where he and a team of his peers worked together using their own personal abilities and experiences to complete a building project for a client. In Lorenzo's senior carpentry classes, he describes the whole class working on different larger projects like decks and pergolas. Students were assessed individually on their knowledge and ability to construct these projects yet, as in the 'real world,' none of them went through the construction process alone. These case studies thus tend to support the thesis that project based technology education supports and encourages the development of transferable life skills.

The ability to cooperate and work in teams is not formally assessed in either vocational or general technology programmes taught at New Zealand secondary

school level. Traditionally teachers and assessors assess whether a student has the individual capability to do a task on their own. It is possibly only because manual capabilities are not assessed in general materials technology that Darcana was allowed the freedom to engage the help of his peers. Hemi and his classmates were working cooperatively on a single project in the context of the BCITO competition, but the work they did for that competition was also used by the teacher (in the same way as for Lorenzo) as evidence for individual competency in building and construction unit standards. Having large, 'real world' projects that necessitate teamwork and cooperation provides students with a learning context similar to work experience. In spite of the traditional emphasis education has on providing individual evidence for assessment, technology teachers can focus the learning experiences of their students on preparing them for the reality of the workplace rather than fitting the learning around providing evidence for assessment.

Chester's school has won the BCITO competition a number of times and Chester's teacher puts it down to the quality and quantity of their written documentation, evidence of the design process and negotiation with their client and not just the quality of the build. These skills are not assessed in the vocational programmes but are pivotal in the general technology programmes. It seems that having students who are skilled craftspeople together with students who are skilled at negotiation, documenting and describing what their team has done is the key to success. Giving students the opportunity to become more aware of their own personal strengths and value the strengths of others is a laudable outcome. However, as Young (2010a) suggests, education must also challenge students to move out of their 'comfort zone' to discover capabilities that they may otherwise never discover in themselves. Working cooperatively gives the students a broad picture of what is involved in completing a 'real life' project, and an understanding of the variety of skills needed.

> Projects that involve interdisciplinary ideas and actions represent the workplace more effectively than trying to isolate and then teach aspects of communication, group work and research for example (Allan, 2007, p. 81).

Allan (2007) describes the benefits for students in taking part in project based learning as "...enhanced problem-solving skills, communication skills, team work

skills and an understanding of the abstract or theoretical concepts behind the project issue including the way these are translated into action" (p. 81).

Problem-solving skills. Problem-solving and the ability to think critically about ones' work have been identified in the literature (e.g., Tufnell et al., 2002; Mayer, 2002; NZIER, 2006) as core skills needed in the workforce. The five students involved in these case studies describe the way they were taught to negotiate problems in their work differently, depending on who taught them. Although there appears to be a different pedagogical approach to problem solving depending on whether it is taught in the context of vocational or general technology education, different teachers have different approaches within the same context. Exploring firstly the problem solving skills taught in Emma's and Darcana's general technology classes and then comparing them to how Lorenzo, Hemi and Chester describe problem solving being taught in their vocational classes, will illustrate these different pedagogical approaches.

Emma describes her general technology graphics teacher as a 'guide', who would help clarify the overall, bigger picture of her project rather than the detail of what she did within that project. She said she would try and solve problems over specific drawing techniques first by herself and then ask the teacher if she still could not work it out. She described one situation where the teacher modelled his own problem solving approach to her when he did not know the answer straight away either. Her teacher describes teaching students to use modelling and mock-ups to help them firstly identify design problems themselves, and then think about how they could solve those problems. Darcana's general materials technology teacher also describes teaching students modelling techniques to test their ideas, identify and solve problems before they start using expensive material. As a consequence he sees the general technology class wasting much less material than the vocational class, where students have set plans to work from and think they know exactly what to do but actually make more mistakes. Darcana describes his vocational electronics teacher obtaining advice from other experts when he asked her about problems neither of them could solve. Darcana described a strategy he used to solve problems as researching existing solutions and modifying them to suit the context of his own project.

If Chester encountered a problem in the practical tasks of his vocational training and asked the teacher for help, his teacher would not just tell him what to do, but also explain the reasons for doing it that way. Hemi describes his two different

vocational teachers as having two different approaches to teaching problem-solving. He said he always stopped work if he encountered a problem and asked his teachers to explain what to do. His carpentry teacher would describe the solution directly. Lorenzo also describes asking the same carpentry teacher how to do something with the teacher sometimes giving a hint about how to solve the problem and sometimes just explaining exactly what to do straight away. Hemi's engineering teacher on the other hand, would use the problem to model his own problem-solving skills to the whole class. He would go away and figure out a solution and then draw the class together to explain the problem and show them his solution. Interestingly Hemi feels he learnt more problem-solving in his carpentry class than in his engineering class. He describes working on a 'real job' and asking for help when he needed it, helped him understand when and why certain skills or tools were needed. Lorenzo, however, feels if he had to figure out the solution more by himself, it 'stuck in his brain' easier. Whereas he feels if he was told the answer straight away, he had to try and remember it without having made sense of the problem first. Although the engineering teacher explains to the class the problem and how he made sense of it, it appears he does not allow his students the experience of making sense of it themselves. All the students, no matter the pedagogical approach taken by their technology teachers, seemed to have learnt most effectively in experiential learning in a contextualised setting.

All the students (whether in vocational or general technology programmes) appear to have gained an ability to work competently and critically in real world contexts. In exposing students to problem-solving, modelling and teaching them those skills, there are marked differences in the pedagogical approaches of the teachers in these studies. This could partly stem from the fact that general technology projects are more student centred and student driven, and vocational projects more teacher-centred and driven. General technology students are more likely toencounter unforeseen problems in their work that their teachers also do not immediately know how to solve. Consequently their teachers are more likely to model their own ways of problem-solving rather than just provide an immediate answer. This is particularly well illustrated by Emma's graphics teachers approach. Vocational students on the other hand, are more likely to encounter problems that their teachers have already learnt to deal with many times and consequently, are more likely to provide the student with a direct answer straight away, as illustrated by Hemi and Lorenzo's carpentry teacher.

Critical analysis. In general technology programmes the ability to think critically, analyse and justify technological practice and the design process is formally assessed within the achievement standard structure. The vocational technology teachers interviewed also described trying to impart to their students, the ability to think critically about what they are doing. The difference being that in the vocational technology programmes this ability is not formally assessed but just taught as part of what teachers believe to be good educational practice. Chester's vocational teacher describes emphasising to his students the importance of critically thinking. He explains that if a carpenter sees an obvious flaw in the way an architect has drawn a set of plans it should be incumbent on the carpenter to point the problem out. He has incorporated a small amount of design flexibility in the projects he sets his students so that they are more engaged with the project and think about how to improve the basic design.

Vocational 'habitus'. Dalley-Trim et al. (2008) describe students perceiving vocational education as providing valuable qualifications and 'life skills' that would give them a 'head start' in their quest for employment (p. 63). This view is consistent with Taylor's (2008) description of school based carpentry apprenticeship trainees developing a 'vocational habitus' or acculturation into the values and attitudes needed for successful employment. Chester describes his vocational technology education involving exactly the skills needed for developing an appropriate vocational habitus, skills that will "stay with you forever and sets you up for when you work in a real workshop…the tricks of the trade." Similarly, Lorenzo said the skills and knowledge he learnt in graphics around sketching and drawing plans gave him a 'head start' knowing what to do on a building site and successfully communicating with other trades people about specific jobs. Chester's teacher describes trying to teach and prepare his students for successful employment by making them aware of the expectations employers have of appropriate behaviour. Hemi and Lorenzo's teacher sees the broader role of his vocational technology education classes as giving students a good work ethic and life skills so they know what is expected in the workforce and will be able to hold down a good job or apprenticeship. He sees carpentry and engineering as just a 'vehicle' to deliver the employability skills and key competencies discussed above. Darcana's teacher aims to prepare his vocationally focussed students to be successfully taken up into the workforce or go on to get further trade qualifications at Polytechnic. The fact that he is seeing many of his students achieve these outcomes even in the present economic

downturn, attests to the value and success of his school's vocational education programmes.

Both technology pathways appear to be providing students with good coverage of transferable key competencies and life skills. However, because of the direct link vocational programmes have with industry, through the Industry training organisations (ITOs) and the industry background of many of the teachers, there is by definition more emphasis on preparing students for transitioning into trades based employment. General technology (also by definition) provides students with a broader context in which students learning can take place. At senior secondary school level this does not necessarily mean that many of the knowledge and skills they learn are less specialised, but they are learnt as a result of their own investigation and need rather than from what their teacher deems important.

That concludes the analysis and discussion of the findings of this study. The following chapter summarises themes drawn out in this discussion, and how the analysis of those themes has answered the research questions.

Chapter 6: Conclusions and Implications

Introduction

This chapter begins by summarising the themes drawn out in the previous chapter around the exploration of the factors that have influenced the five young people involved in this research and the choices they made in regard to their secondary school technology education. In doing so it seeks to address the first research question; what factors influenced these five young people in the choices they made regarding their secondary school technology education? It then summarises the differences and similarities between general and vocational technology revealed in this study, with the aim of answering the second research question; what knowledge and skills were taught in these young peoples' secondary school general and vocational technology education programmes? The next section deals with how the knowledge and skills delivered in vocational and general technology education are valued by the young people involved in this study with the aim of addressing the final research question; how do these young people perceive the relevance and usefulness of the knowledge and skills they were taught in their technology education? The chapter goes on to discuss implications arising from this research and proposes a way forward for the further development of secondary school technology education in relation to the conclusions drawn from this research. To conclude the chapter, suggestions are made for opportunities for further research.

Factors Influencing the Young Peoples' choices

Five factors that had bearing on the choices the students made involving their technology education were identified and discussed in the previous chapter. They are:

1. Family background;
2. The environmental context in which their secondary school exists, i.e. what type of community it serves, rural or urban, working class or professional;
3. Financial considerations of both their families and their schools;
4. The students' own abilities and aspirations;

5. The educational philosophy and priorities held by the school's management.

However, the data revealed that it is contestable as to how much truly agentic choice students have in their education. As a consequence, this research has discussed in detail the fact that people are bounded in their actions (and the degree of their own agency within those actions) by their backgrounds, upbringing, their socio-economic status, culture and ethnicity, along with the social and cultural structures within which they conduct their lives. To focus on the five young people presented in this research, in a similar way to the students in Lehmann's (2005) study, they appear to have made agentic choices as they progressed through their schooling even though those choices were situated in a context of socio-economic and cultural capital. However, the predominant factor that has influenced the *outcomes* of their secondary education (not their choices) is their family background. Financial and economic considerations have also played a significant role in determining the realities of the five young peoples' outcomes and their willingness or even ability to fund further tertiary study. Based on evidence from this research, it appears that working class families display more reticence about going into financial debt for education than families that either do not have the same financial concerns, or that have a tradition of pursuing academic education.

Family background appears to have overridden any other structural influences from their schools, for example the school's socio-economic decile, whether or not it offered senior general technology programmes, its environmental context, school policy on vocational programmes. However, the structure of the traditional academic curriculum appears to have played a part in discouraging these young people (with the exception of Emma) from pursuing any choices that they did make to take more academic subjects (c.f. Darcana with mathematics, Lorenzo with physics and Chester with English). It can be concluded from this data, that the education these young people received did not offer sufficient support for them to succeed in any aspirations they had beyond the familiar outcomes of their family background. Emma did achieve academically but it could be argued that her aspirations also did not go beyond what was familiar to her from her family background.

Sociocultural theory describes education as acculturating young people into specific communities so they can be positive members of those communities.

Similarly, Taylor (2008) describes vocational education as giving students a 'vocational habitus' that acculturates them into the values and attitudes of specific work communities. Bourdieu (1977) describes education as contributing to social reproduction where families in working class communities have children that continue that working class tradition. Because all the young people in this study have come from working class family backgrounds, according to the literature they are predisposed to taking subjects that reflect that background and as a consequence, were drawn to technology education. Within technology education, they had the choice of taking general technology or vocational technology programmes. Within schools, the study revealed that general technology education has the reputation of being academically challenging. However, within the rest of society that reputation does not follow. The literature review revealed that technology education in general has a stigma attached, that it is less valuable than traditional academic subjects because of its delivery by a subject department that is perceived as solely involved in training students for trade vocations.

These students' family background impacted on the direction their education took, the school they attended and the subjects they studied. Their schools' management and teachers made decisions about the direction and focus of their schools' technology departments within each school's specific environmental context. The data in this research points to school management tending to favour their technology departments delivering vocational programmes rather than general technology programmes at senior secondary level because of structural issues such as timetabling and staffing concerns. These issues limited the schools opportunity to offer both types of technology education programmes. The technology education offered by the schools seems to be a response to cater appropriately to the needs of families in the school community.

The dual pathways of general and vocational technology

Vocational technology education continues the trades training focus that is the general perception of what technology education involves. It is still popular with many students who have aspirations to go into the trades and with many technology teachers who are ex-trades people themselves. Vocational technology teaches repeatable specialised practical skills and knowledge involved in specific vocations through the provision of more teacher-driven,

standardised projects. Students are expected to transition directly into trade apprenticeships or further their training at a polytechnic.

In their position as intermediaries between schools and industry, Industry Training Organisations (ITOs) can guide the learning that is occurring in vocational technology classes to reflect the needs of industry through the content of the teaching and assessment material they provide to schools. This material focuses on the development of students' knowledge and skills in the manipulation of workshop (or kitchen) tools and materials to achieve specific tasks. The research describes national competitions that ITOs run, providing an opportunity for teachers to engage their students in 'real life' projects that have the potential to involve students in more holistic learning contexts. However, it is up to individual teachers whether they have their students enter these competitions or not, and, for lower socio-economic schools, there can be financial and resourcing constraints that limit their students' success.

General technology programmes on the other hand, emphasise student-driven, individualised design projects as a basis around which to deliver the curriculum, rather than an optional addition to the programme. General technology concentrates on design of novel, innovative prototypes and encourages pathways into academic university study. The NZ Curriculum (2007) does not describe grade level indicators for manual skills and competencies in general technology education. As discussed in Chapter 5, this may have encouraged the over-emphasis of written, design work and the focus on providing individual evidence for assessment with the resultant reaction against general technology education by both students and teachers.

Both the review of literature and the data collected in the case studies indicate that knowledge and skills in manual processes are equally as important as knowledge and skills in the design process. Without a solid foundation in manual processes students who begin self directed projects may not have enough background knowledge and basic skills to give them the self-belief and confidence to complete that project. Manual skills are a primary focus of vocational classes where students are provided with standardised projects that are specifically designed to teach practical capabilities. Once learnt, these skills can be used again to make other artefacts (perhaps of the students' own design). Practical elements involving manipulation of tools and materials to make these

projects provide a fundamental basis that creates the foundation onto which design and innovation can be developed and encouraged.

Perception of the relevance and usefulness of technology education

The inclusion of assessment credits gained in vocational programmes counting towards students gaining their NCEA qualification has, to some extent, democratised access to this nationally recognised scholastic qualification. In today's job market which requires higher and higher degrees of formal qualification, having students gain their NCEA qualification through achievement in vocational programmes has allowed students who may otherwise have left school with no qualifications and little hope of employment, some chance of successful transition into the workforce. Unfortunately for students like Hemi, Lorenzo and Darcana, the job market has been so competitive that their transition into life after secondary schooling, no matter the level of qualification they gained at school, was either into low skilled, casual labour, unemployment or to seek further tertiary level qualifications.

Analysis of the case studies revealed the traditional pedagogical approach of teaching vocational 'theory' through rote learning is ineffective. Even students who described preferring the more predictable, structured nature of vocational classes were actively engaged in 'real world' projects that required them to transfer and apply their theoretical knowledge and practical skills in the context of their project.

In comparison to more traditional academic subjects, general technology education appears to have more positively supported those young people who took it in achieving some academic success. Lorenzo, Emma and Darcana, who studied general technology (either graphics or materials technology), seemed to enjoy the subject, felt challenged by it and achieved success in gaining credits towards their NCEA qualifications in spite of its more academic focus. This leads to the conclusion that general technology can be a way to engage more practically orientated working class school children in an 'academic' subject. However, the research points to an issue where the opportunity to offer and engage students in general technology at senior secondary school level is not being taken up by some schools, and given up by others.

The Chapter 2 literature review concluded by describing a conjunction of vocational and general technology education, with the point of conjunction being

in the delivery of key competencies and transferable, employability and general life skills. After analysing the responses made by the participants in the case studies, it appears that it is these skills, taught in both vocational and general technology programmes, which are perceived as more valuable than those that are subject specific and specialised. The skills identified in the analysis of the research findings were cooperative skills, problem-solving and critical analysis. Studies have shown that trades based employers require competency in basic literacy, numeracy and communication skills (e.g. ISC, 2011; Tufnell et al., 2002), alongside a degree of manual dexterity and practical skill (e.g. Sianez et al., 2010; NZIER, 2006). Both vocational and general technology education at senior secondary school level, are able to provide engaging ways to develop these skills by contextualising learning within specific, 'real world', project based tasks.

Summary

To summarise the main points and conclusions from the sections above:

- Traditional vocational technology education that teaches task specific skills, although useful in engaging 'hands on' students and building their confidence in fine motor skills and manual ability, runs the risk of becoming outdated in the fast changing needs of today's labour market. It has not substantially helped the students in these case studies transition successfully into employment.

- The academic liberal model education system disadvantages many students from lower socio-economic, working class backgrounds, as evidenced in these case studies.

- The general technology education curriculum has had a difficult period of implementation in New Zealand schools because of issues around gaining academic credibility without losing the 'practical' element that encourages and engages students.

A Way Forward

As discussed in chapter 5 in relation to Science, Technology, Engineering and Mathematics (STEM) educational initiatives, technology education has the potential to provide a meaningful context in which conceptual knowledge from more academic subjects such as science and mathematics can be integrated. Both the literature and the findings from this research suggest children from non-

academic households who value practical skills over academic, due to their family background and inherited cultural capital, are either unlikely to choose academic subjects at school or if they do, are unlikely to succeed in those subjects. Incorporating and valuing manual skills and practical capabilities in a meaningful way within general technology programmes that contextualise learning in 'real world' projects may provide a pedagogy that suits both the needs of students and the realities of preparing them for the fast-paced modern world. As illustrated in these case studies, different students have a range of interests and personalities. Some students come with a greater amount of prior knowledge and experience and will need appropriately pitched projects to engage them. Allowing teachers flexibility to individualise the content or focus of students projects to reflect their individual interests, abilities and aspirations may positively engage them in their learning. Students who are more interested in a design focus and exploring the knowledge and theoretical concepts that underpin technological practice could concentrate their projects in that area but still within an engaging 'hands on' context. Students who are more interested in the manual assembly and construction skills could equally focus on that element of a project yet still be exposed to theoretical concepts within the context of the project. This model provides the 'curriculum of engagement' Young (2010b) describes which students can apply to both academic futures in, for example, engineering or design, and vocational futures in the trades. It also represents the original intent of the general technology curriculum.

With the recent New Zealand review of the assessment structure at senior secondary school level, many more practically focussed achievement standards are becoming available for students to be assessed against. Consequently, teachers have an even greater opportunity to design engaging project based learning programmes and fit the assessments (whether ITO unit standards or general technology achievement standards) to the learning rather than designing programmes to fit the assessments. Greater opportunity is available for teachers to cater for the variety of young people, their aspirations and abilities, without compromising the depth of teaching of either design or manual processes, and without having to split their technology programmes into either vocational or general. The Ministry of Education has now, what appears to be, an assessment structure that recognises the value of both the vocational pathway into trades and the academic pathway into professions like engineering and design. Considering the vocational background of many technology teachers and the difficult

implementation the general technology curriculum has already had, the Ministry will need to provide teachers with the encouragement, support and guidance to use these new standards. Technology teachers will need to make the best use of that structure to deliver engaging and valuable programmes of learning to a wider range of students.

Suggestions for Further Study

An area for further research that arises from this study is to explore the relative merits of the highly specialised, separate subject based curriculum as opposed to a more integrated approach to education. Alongside this, research could be conducted to investigate how the more integrated STEM model could be incorporated and delivered in secondary classrooms and whether it is effective in conveying theoretical concepts from mathematics and science in ways that are understood by both academically and practically minded students.

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Appendices

Appendix 1 *Invitation to participate in the research*

Centre for Science and Technology

Education Research

The University of Waikato

Private Bag 3105, Hamilton, New Zealand

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Interview Invitation

Dear …….,

My name is Nicholas Bowskill and I am the Head of the Technology Department at Ngaruawahia High School. As part of completing a Masters in Education at the University of Waikato I am conducting research aimed at gaining an understanding of how Technology Education and vocational training are viewed and delivered at senior secondary school level, and whether recent secondary school graduates who have undertaken technology education at this level perceive it as valuable. The title of the project is "Student perceptions of the value of general and vocational education in technology – a case study."

I intend to conduct interviews with recent secondary school graduates, their ex teachers and caregivers to gather appropriate data.

I am writing to request your participation in an interview. The interview would be up to one hour long and can be conducted at the University of Waikato, Centre for Science and Technology Education Research, or an alternative place of your choosing, and at a convenient time. I would like to audio record the interview but all care shall be taken to protect your anonymity. In the written report all real names will have pseudonyms and all hard copies of audio files, interview transcripts, and computer files containing raw or processed interview data will be kept confidential and securely stored in a lockable office or on the researcher's password protected computers and/or backup media.

I will provide you a draft transcript of your interview for comment as soon as it is available. Participation in this research study is voluntary, and you have the freedom to withdraw at any point up to two weeks after receiving the draft transcript of your interview.

The information gained from this study will be used only for the purpose of gaining my Masters of Education qualification and possible conference presentation or publication in academic journals.

Before agreeing to take part in this interview, please read the following declaration and then, if you agree with the terms listed below, and are interested in participating please confirm your interest by e-mailing me at nrmb1@waikato.ac.nz or telephoning me at (07)827 8289. If you have any queries that I cannot resolve, the director of this study, John Williams can be reached at pj.williams@waikato.ac.nz, phone: (07)838 4769. I will also make

contact with you before the 12th May, 2011 to confirm your participation and discuss suitable times and venues for your interview.

Yours sincerely

Nicholas Bowskill

Appendix 2 *Consent declaration*

Declaration

Regarding my participation in the interview, I understand and agree that:

1 My participation in this research is voluntary.

2 I will be involved in a study about students' perceptions and attitudes towards Technology Education and vocational training in NZ secondary schools.

3 Data gathered for this project will not be made available to any third party and will be subject to the provisions of the New Zealand Privacy Act (1993).

4 I will not be identified in any way other than a code number or pseudonym in data records or reports of the research findings.

5 My participation in this project will not in any way affect my current study or employment.

6 I may withdraw from this study at any stage up until two weeks after receiving the draft transcript of my interview.

7 If I have any concerns about my participation in this research project I can contact the director of CSTER, John Williams – phone: (07)8384769, email pj.williams@waikato.ac.nz

☐ I am willing to be interviewed as part of this research and for that interview to be audio recorded.

Signed _____ **Date** _____

Appendix 3 *Interview questions*

Student Graduates

1. Can you describe the course structure of technology at your school, ie. What you did or could have done in technology in Y9, Y10 etc.?
2. What technology subjects did you do in your junior secondary school years?
3. What technology subjects did you do in your senior secondary school years?
4. What or who made you choose those particular subjects?
5. What aspirations for your future did you have at school, were they a factor in your choosing to do technology subjects?
6. How do you perceive the academic requirement of (different tech subjects offered at their school)?
7. How did you perceive your own academic ability at school?
8. Can you describe the projects you made in (senior level tech. subject). Did all students make or draw exactly the same thing?
9. Can you describe the written work you completed as part of those subjects.
10. What did you enjoy about the technology classes you did?
11. What didn't you enjoy about those classes?
12. Generally, how did you deal with problems you encountered in completing your project work? Did you:

    try and work out how to get around the problem yourself

    straight away ask the teacher

    ask someone else like another classmate, your parents, another expert you know.

13. What part did your teacher play in teaching or guiding you to the successful completion of your work?
14. Was there ever anything you wanted to know or got stuck with that your teacher couldn't help you with?
15. How was that dealt with, if at all?
16. What skills or competencies do you think you learnt in your technology classes?
17. Do you think those skills and competencies had a different focus in the junior school to the senior school?
18. How are those skills or competencies useful to you now?

Teachers

1. Can you describe the course structure of technology at your school?
2. What is your background before you came teaching?
3. How do you see the perceptions and attitudes of your school's management team, other teachers, tertiary institutions, students' parents to the technology department and the subjects it offers?
4. What is your opinion of the new technology curriculum and level 1 assessment matrix?
5. How would you describe your role in teaching junior technology subjects, and senior technology subjects?
6. What skills or competencies do you want your students to walk away from your classes with?
7. Are those different for the unit standard courses compared to the achievement standards courses?
8. Where do you expect to see your students go to after they leave school?
9. Did you have similar aspirations or expectations of (student graduate's name)?

Caregivers

1. Can you describe your own educational background and employment history?
2. What is your perception of schools' technology departments, the subjects they offer and the students they teach?
3. Can you describe your son/daughter's aspirations and perceived academic ability as they progressed through secondary school?
4. What do you think influenced these aspirations and the perception of their academic ability?
5. What or who influenced the decisions your child made in choosing the subjects they took at secondary school?
6. Did you have any input into the choices your child made?
7. What skills or competencies do you think your child learnt in their technology classes?
8. Do you think the education they received in these classes is useful to their lives now? How?