MOVING FROM TECHNICAL TO TECHNOLOGY EDUCATION: WHY IT'S SO HARD!!

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ABSTRACT

The constructs that underpin a curriculum play an important role in determining the pedagogical practices used by teachers to deliver these inside classrooms. The prior experiences and training of teachers also assist in determining the nature of the pedagogical practices that are used. This paper will discuss the issues that face teachers of technology who have a background in traditional technical education. These issues are explored in terms of the similarities and differences between ideologies and learning theories that underpin traditional technical and technology education, and how these have been translated into pedagogical practices inside New Zealand classrooms. The paper concludes with suggestions as to how these issues may be resolved within the framework proposed by the revised technology curriculum.

1. INTRODUCTION

The history of technical education in New Zealand has implications for technology education, not least due to the fact many teachers involved in earlier technical-related subjects are now involved in the delivery of technology. The roots of these technical-related subjects are therefore worthy of exploration when developing an understanding of the issues facing these teachers in the delivery of technology in classrooms today.

This paper will focus on three distinct eras in the development of technical and technology education in New Zealand:

- Technical Education pre 1975
- Technical/Technology Education 1975 -1992
- Technology Education 1993 to present day.

It will describe the ideologies that underpinned their development, the nature of student learning and the implications for teachers' pedagogical practices for each, and concludes with recommendations of possible ways forward to address the issues inherent in the shift from technical to technological education.

2 DISCUSSION

2.1 Technical Education pre 1975

The 1877 *Education Act*, outlined a framework for national schooling for all New Zealand children, and provided a foundational framework to enable technical education to be implemented – specifically under the *Act for the Promotion of Elementary Technical Instruction* of 1895 (New Zealand Statutes, 1895). This Act, commonly referred to as the 'Manual and

Technical Act, 1895' (McKenzie, Lee and Lee, 1990), made a clear distinction between the 'manual instruction' to be offered in primary schools and 'technical instruction' within secondary schools. Manual instruction, it proposed started with modelling in any materials and led onto "the use of tools to woodwork for boys and cookery for girls" (Watson, 1964, p.13). The impetus for introducing this *Act* came from the then Inspector General of Education, George Hogben. He argued the need for manual instruction that put children in touch with tangible realities to counter the 'bookishness' of existing curriculum (McKenzie, 1992). Under the *Act*, manual instruction was to allow students to achieve "a natural co-ordination of all subjects in the (school) course with life" and give them opportunity to "discover aptitude" *(Manual and Technical Instruction Act* – cited in Mawson, 1998 p.2). Despite this viewpoint, manual instruction established itself within middle school education (years 7-10) as subjects that were delivered in isolation within specialist woodwork, cooking and textiles rooms.
In 1903, the New Zealand Premier, R. J. Seddon introduced free post-primary education for all students who passed the standard six Certificate of Proficiency. This resulted in a major increase in the number of students that entered secondary education. A need for alternative courses was acknowledged for students who lacked the academic ability to pursue conventional secondary schools subjects (McKenzie, Lee and Lee, 1990). To address this need, the 1895 *Manual and Technical Instruction Act* was reviewed and on the 13th October, 1900 the new *Manual and Technical Instruction Act* was passed into law *(*New Zealand Statues, 1990; McKenzie, Lee and Lee, 1990). This *Act* meant that secondary schools were required to extend their traditional academic curriculum to incorporate technical subjects that provided alternative pathways for non-academic students. Despite the introduction of this *Act*, there was a general reluctance by parents to enrol their children in technical subjects. This was due to their being "stamped with the label of social inferiority" (McKenzie, Lee and Lee, 1990, p.4) and as such, limiting their child to later employment as low-paid, unskilled or manual workers.

A reluctance to introduce technical instruction was also prevalent within the secondary schools themselves. This was partially due to the expense associated with offering practically orientated courses, but also aligned to the stigma associated with being seen within the community to offer non-academic education (Watson, 1964; Compton, 2001). To encourage secondary schools to introduce technical education into their curriculum the Government therefore provided financial incentives, including attendance support for students (McKenzie, Lee and Lee, 1990). Where students were denied access to technical education in their school, they were encouraged to enrol, by having their fees paid in full by the Government, in technical night classes. Associations such as the Dunedin Technical Classes Association conducted these night classes. In 1905 this provision was extended to establish day technical schools for junior high school students which offered programmes in agriculture, art, industrial and commercial courses. This advent marked the birth of technical high schools in New Zealand, or as they became more commonly known - *technical colleges*.

Despite the Department of Education efforts at the time to discourage these schools from developing specialist vocationally focused programmes, they never the less did so - establishing skills based programmes in response to pressure from the employment market, (McKenzie, Lee and Lee, 1990). These programmes helped to reinforce the inequalities of education that made clear distinctions between those students who could later, at senior secondary, access education that allowed their entry into professions that were deemed by society to have status, and those who were destined for manual work. Thus the distinction between the education received by those who would later become the 'white collar' professionals in society, and the 'working class', was further reinforced (McKenzie, Lee and Lee, 1990; O'Neil and Jolley, 1996; Compton, 2001).

By 1926, Caughley was calling for the leaving age of secondary school students to be raised from 12 to 15 years and for the abolishment of technical schools. In their place he promoted the establishment of comprehensive post-primary schools that offered 'multi-lateral' curriculum (Compton, 2001). These schools were to provide all students with a sixty percent common content based programme, with the remaining time being divided into two areas of semi-specialisation; either 'academic' or 'non-academic'. Under Caughley's proposal, students remaining at school could, after 15 years of age, "pursue either a specialised academic course or a technical course for a further three years" (McKenzie, Lee and Lee, 1990, p.24).

A discussion document on future policy options for education titled *Education Today and Tomorrow* (Department of Education, 1944 – cited in McKenzie, Lee and Lee, 1990) instigated the establishment of seven senior technical colleges. These colleges were set up to specifically to train students for entry into the industrial workforce, and provide ongoing post-secondary education to people in the workforce, by offering day and night-school apprentice classes. These seven senior technical colleges provided the impetus for the establishment of Polytechnic Institutions in New Zealand. The 1962 *Currie Commission* called for secondary schools to offer 'a more comprehensive education to all students and for pre-workplace and apprenticeship training to be provided by the Polytechnics. Over the next fifteen years those technical schools that remained either re-branded and extended their curriculum to become *comprehensive secondary schools* (for example in Palmerston North, Queen Elizabeth Technical College re-branded to Queen Elizabeth College) or amalgamated with an existing conventional academically orientated secondary school.

2.1.1 Underpinning Ideologies

The prescriptions for *manual* and *technical education* specified the skills, practices and attitudes to be taught, and how schools should structure their teaching programme. They also actively promoted gender segregation by defining gender-biased curricula (O'Neil and Jolley, 1996; O'Neil, 1996; Compton, 2001). Boys' *manual* and *technical education* was focused on metalwork, woodwork and agriculture while girls' education was centred on their preparation for entry into domestic and commercial (e.g. typing, shorthand, bookkeeping) service. Such gender differentiation was later perceived to be a deliberate attempt to put the 'new woman' who emerged from the suffrage and temperance movements that presented an uncomfortable challenge to male dominance, in their place (O'Neil and Jolley, 1996; Mawson, 1998; Compton, 2001). This male backlash was given credibility by Dr Truby King, a Superintendent of Seacliff Mental Asylum in the early 1900's whose biological deterministic views espoused the need for differentiated curriculum from puberty onwards, in order to protect both girls and society. "He argued this in terms of the harmful effects of mental stimulation on the physiological and psychological development of girls" (Compton 2001, p.14).

Along with delivering gender differentiated technical education, the positioning of technical education as non-academic and vocationally orientated subjects added support to the belief that the purpose of education was for 'social replication', that perpetuated the continuance of a society differentiated by class and gender (McKenzie, Lee and Lee, 1990; Mawson, 1998; Compton 2001). As reported by Fry, this feature of education was rarely questioned from 1900 to 1970, as it reflected the dominant traditional assumptions regarding the role of women, as discussed above, and the need to retain existing 'social order' (Fry, 1985 – cited in Compton, 2001).

2.1.1 The Nature of Student Learning and Implications for Pedagogy

To support classroom delivery, specialist homecraft (food and textiles) rooms, and wood and metal workshops were created in schools to deliver manual and technical education. Classroom curricula for this education placed importance on the creation of products with high 'take home value' (Mawson, 1998: Compton, 2001). The content (knowledge and skills to be learnt) taught in classrooms was focused on allowing high quality crafted wood, metal, textiles and food products, to be produced. The pedagogical practices of teachers that supported this content centred on the 'lock-stepped' construction of products in accordance with teacher predetermined plans (woodwork and metalwork), patterns (textiles) or recipes (cooking), is attributed to the pre-training apprenticeship experiences of technical teachers and their desire to ensure students produced quality end products (Watson, 1964; Mawson, 1998; Compton 2001). Curricula in technical classrooms were therefore based on *subject-centred* design (Print, 1993) that focused on imparting a predetermined body of content (knowledge and skill) to students.

This approach to learning was embedded in behaviourist theories of learning (Shepard, 2000) in order to support students to attain the desired competencies (Compton and Harwood, 2004). Behaviourist learning theory views knowledge as "independent of the inquiry that discovers it" (Dwight and Garrison, 2003 p.703) and validates that student learning can be totally predetermined and organised by the teacher prior to the learning experience. Under behaviourist learning theory, assessment of student learning (their understanding of knowledge and ability to perform skills) can also be validated outside of any learning experience. As such the focus of assessment under behaviourist learning theory is on ascertaining the knowledge and skill retained by students as a result of a specific behaviour/activity (Bobbitts, 1997 - cited in Dwight and Garrison, 2003).

In adopting behaviourist approaches to learning, technical instruction received strong criticism from Campbell in 1941. He reported that the manual-technical training offered "the most glaring instances of rigid formalism" (Campbell, 1941 p. 94 - cited in Compton 2001). He went on to say that "It was a form of technical training that quite overlooked the creative impulses of children… it certainly implanted sterile conceptions of art and handwork" (Campbell, 1941 p.94-95 - cited in Compton 2001). Despite these criticisms, teachers of woodwork and metalwork were not encouraged to change their behaviourist pedagogical practices until 1975, when *Workshop Craft* was introduced and mandated as the curriculum for technical education for hard materials (woodwork and metalwork) for year 7-10 students. The homecraft curricula for home economics and clothing and textiles, did not follow the hard material lead however and continued to endorse behaviourist practices.

2.2 Technical Education 1975-1992

Enlightened by the recommendations of the Currie Report (Department of Education, 1962), that curricula should be established through a consultation and consensus model, rather than using a 'top down' centre-peripheral model (McGee, 1997) a conference on educational development was conducted at Lopdell House in 1972. One outcome of this conference was a new *Form 1-4 (years 7-10) Workshop Craft* curriculum in 1975, and a Form 5 (year 11) *Workshop Technology* curriculum two years later. These sought to replace technical education as previously prescribed in the Thomas Report. These two curricula promoted a significantly different approach to technical instruction compared to previous technical syllabi (Compton, 2001). While their focus was still on the development of products that had 'take-home value', design and related studies was also introduced as important features to be focused on. Although the use of a wider range of materials was also promoted by these curricula, classroom programmes continued to focus on materials traditionally used in previous syllabi. Justification for this continuation centred on resource constraints of previously equipped specialist rooms (Harwood, 2002). At this time, no significant curriculum changes occurred for the cooking, needlework and laundry work syllabi (Compton, 2001).

2.2.1 Underpinning Ideologies

Major changes in these curricula was the inclusion of 'design' and the need for students to take an active role in the design and decision-making about what their projects (products) would look like and function. *Workshop Craft* and *Workshop Technology* divided its curricula into three strands – design, craftsmanship (sic), and related studies. Significant in the shift to *Workshop Technology*, was the movement away from "content driven, exam oriented curriculum" to an examination that was "design focused, that covered a range of materials and was fully internally assessed within a framework of a national moderation system" (Mawson, 1998, p.2). Therefore creativity-through-design and a recognition of practice based learning and assessment were key drivers in this curriculum. Previous Engineering Shopwork and Woodwork examinations for School Certificate had examined student's theoretical knowledge of the subject. This change not only necessitated a significant change for classroom curricula at year 11, but also influenced the instruction provided in year 7-10 classrooms (Harwood, 2002).

By the mid 1980's teachers of home economics and textiles were beginning to realise the limitations of their subjects under traditional School Certificate theory examination. An awareness of the impact that the introduction of an ideological 'creativity-through-design' had

had on the previous engineering shopwork and woodwork curricula, lead a number of these teachers to revise their courses to meet the aims and objectives of *Workshop Technology* and to enter their students for School Certificate examination under *Workshop Technology* (Harwood, 2002; Rimmer, 2004). By 2001, approximately ninety percent of all students who undertook a textiles programme in year 11 entered the *Workshop Technology* examination for School Certificate (New Zealand Qualification Authority, 2001). A significant number of food teachers also changed their courses to introduce design, entering their students in the year 11 *Workshop Technology* examination. In these schools, the years 9 and 10 textiles and home economics programmes undertook major review (away from the technical education syllabi for clothing and textiles and home economics) in order to prepare students for study in year 11 (Rimmer, 2004).

Along with the introduction of *Workshop Craft* and *Workshop Technology* came a significant push to remove the gender differentiation of previous technical subjects, by encouraging girls to take part in courses that had traditionally focused on the use of wood and metal, and similarly boys' were introduced to foods and textiles courses at manual centres and intermediate schools (Mawson, 1998; Compton, 2001). Teachers were also encouraged to provide gender inclusive curriculum for these subjects in secondary school programmes. This ideological shift away from gender differentiation also reflected a more general shift towards creating more 'equal' learning opportunities - and as such represented a changing view of education for social replication to education for social change.

2.2.1 The Nature of Student Learning and Implications for Pedagogy

The introduction of *Workshop Craft* (Department of Education, 1975) and *Workshop Technology* (Department of Education, 1977) paved the way for a change in how curricula was constructed and delivered in hard material classrooms. The opportunity for student centred design to influence the nature of the products produced, meant that teachers could no longer predetermine all of the content knowledge and skills that students needed to manufacture products. To allow the potential of the curriculum to be realised, the design of classroom curricula therefore required a *problem-centred* approach (Print, 1988) and that teacher pedagogy be aligned to constructivist rather than behaviourist learning theories.

Unlike behaviourist learning theory, constructivist theories of learning are based on cognitive theory, where learning is considered to be an "active process of mental construction and making sense" (Shepard, 1999, p.6). Knowledge within constructivist theories is not seen as fixed, but rather is evolving and intimately connected with the knower. That is, knowledge that is constructed by individuals is mediated by social interaction within specific domains and is validated by consensus amongst experts within that domain (Compton, 2004). Packer and Goicoechea (2000) however, argue that constructivist stances are similar to behaviourist in that they are underpinned by dualist ontology. That is, knowledge that is constructed within a specific social context can also be identified and described as separate to the context where it was constructed (Compton 2004). Therefore, while acknowledging that learning evolves during the activity with students actively participating, constructivism also encourages teachers to develop learning outcomes prior to the learning experience, to ensure that students can develop knowledge and skill that are in keeping with those that are deemed to be 'correct'.

To support student learning in *Workshop Craft* and *Workshop Technology* teacher pedagogical practices therefore, needed to both identify 'key' learning outcomes to provide direction to student learning and provide opportunity for students (in negotiation with their teacher) to identify their own learning needs as informed by the ideas they play with to develop their products (Compton, 2004: Compton and Harwood, 2003). As such, teachers' pedagogical practices in planning for and supporting the delivery of *Workshop Craft* and *Workshop Technology* classroom curricula needed to provide opportunity for students to express their creativity by having input into their own learning. The 'locus of control' (Stewart and Nolan, 1992) over what was learnt therefore shifted, from being the sole responsibility of the teacher as it was under *Manual and Technical* education, to allowing student input.

Despite intense teacher professional development however, teachers continued to prioritise the creation of predetermined products with supposed high 'take home value', over allowing student input into their product's design (Mawson, 1998; Compton, 2001, Harwood, 2002). As such, teachers predominantly placed importance on instructing students on the technical aspects of tool use, material selection, and construction techniques, rather than supporting students to express their creativity through developing understandings (and skills) as an active process of mental construction (Shepard, 1999). Further to this, students were rarely supported in exploring the social setting of product development. For example, when designing products under *Workshop Craft* and later *Workshop Technology* students were not expected to consider consumer preferences, seek stakeholder opinion or feedback, or explore the environment in which a developed product was to be placed. Commonly students justified their design decisions based solely on their own 'likes' and dislikes' (Harwood, 2002). Similarly, the 'related studies' undertaken by students often failed to inform their design ideas and/or manufacture of their products. At best, the majority of these could be described as 'unrelated' rather than 'related studies' (Compton, 2001; Harwood 2002) and were seen as a 'waste of time' by students and teachers alike in many instances. This meant that teacher's pedagogical practices centred predominantly on predetermined learning outcomes that were skill focused. The pedagogical strategies used inside classrooms therefore, continued to be primarily behaviourist in nature (Harwood, 2002).

While small shifts in gender differentiation were discernable during this time, boys still dominated the groups opting to continue in the areas of hard materials, and girls in home economics and textiles. Similarly, these courses were still perceived by students, teachers and caregivers to be primarily suited for 'lower ability' students and as such were still located in an implicit vocational education framework.

2.3 Technology Education 1993-Present Day

By 1985 the Director of Education, Bill Renwick had shown interest in the global trends in 'technology' education and the parallel trends within existing school subjects to include more 'technology' in their curriculum. For example, science was including technology in terms of an applied science focus, social studies was focusing on technology from a technological deterministic focus, and information technology primarily by way of computer studies was growing in schools (Compton, 2001). Don Ferguson, who was a member of the policy division of the Ministry of Education, responded to Renwick's interest and presented a review and critique of international developments in technology education. Technology was included as one of the seven Essential Learning Areas identified in the *New Zealand Curriculum Framework* (Ministry of Education, 1993a). The first draft of a technology curriculum, *Technology in the New Zealand Curriculum Draft* (Ministry of Education 1993b), was developed and released into schools for comment at the end of 1993. The final version, *Technology in the New Zealand Curriculum* (Ministry of Education 1995), was released in 1995, was officially launched in late 1995, and gazetted in February 1999 as mandatory for all schools from years 1-10.

The overall aim of *Technology in the New Zealand Curriculum* (Ministry of Education, 1995) was to allow students to develop technological literacy through undertaking technological practice. To achieve this aim the curriculum was structured around three interconnected strands: Technological Knowledge and Understanding, Technological Capability, and Technology and Society. It required that students were given opportunity to develop knowledge and skills through actively participating in the development of technological outcomes (products, systems and/or environments). To develop such outcomes, students were expected to undertake technological practice that considered the needs and aspirations of people who:

- could interact with a technological outcome once implemented in their intended environment; and
- may potentially be affected (both positively and negatively) by the development of a technological outcome.

The introduction of *Technology in the New Zealand Curriculum* (Ministry of Education, 1995) therefore required students to consider the physical and social environment in which their outcomes were developed and ultimately placed. To do this, it was expected that students would take into account the values, ethics, attitudes and expectations of people (stakeholders) within the community where their practice takes place. *Technology in the New Zealand Curriculum* (Ministry of Education, 1995), placed emphasis on the technological practice students undertook to develop quality technological outcomes. However, it measured this not by teacher-predefined criteria based on 'take home value', as with previous technical subjects, but on students' ability to develop technological outcomes that were 'fit for purpose'.

Technology in the New Zealand Curriculum (Ministry of Education, 1995) broadened the range of technological areas that could be used as a focus of study (Ministry of Education, 1995). These technological areas, considered to be of significance to New Zealand's successful future included: biotechnology, food technology, information and communications technology, electronics and control technology, production and process technology, structures and mechanisms, and materials technology. Incorporation of these technological areas within the technology curriculum allowed some of the knowledge, skills and practices that were traditionally aligned to subjects such as science, computer studies and social studies to be introduced in technology education. As such, technology provided students opportunity to learn knowledge, once primarily taught in these subjects, within a practical context when developing technological outcomes. To ensure that students were not limited by the knowledge and skills that they had opportunity to draw upon, a variety of overlapping contexts (such as personal life, home, school, recreation, community, environment, energy, production and supply, business, and industry) were identified within the *Technology in the New Zealand Curriculum* (Ministry of Education, 1995), to provide a focus for the development of student technological outcomes.

In 2002, as part of review of the *New Zealand Curriculum Framework* (Ministry of Education, 1993a) a Curriculum Stocktake of all Essential Learning Areas was undertaken by the New Zealand Ministry of Education. The major outcome of this Stocktake was the decision to redefine the 1993 curriculum framework and develop a new curriculum framework as part of the *New Zealand Curriculum and Marautanga Project* (*NZCMP*). Under the NZCMP the overall aim of technology in allowing students to develop 'technological literacy' through participating in technology education was retained. However the nature of this literacy was extended to address limitations that had been identified in the technological practice reliant literacy that had been advocated by 1995 technology curriculum (Compton and France, 2006; Compton and Harwood 2006) To enable this extension, the curriculum strands for the revised curriculum (Ministry of Education, 2006) were re- conceptualised to:

- Nature of Technology;
- Technological Knowledge; and
- Technological Practice.

These three strands are seen to work together to support students to develop a broader, deeper and more critical technological literacy than previously advocated (Compton and France, 2006; Compton and France 2007; Compton and Harwood, 2006). The list of technological areas has been replaced with a list that now describes a broad range of related technologies (Ministry of Education, 2006). This list includes technologies associated with the transformation of energy, information and materials and includes areas such as technology control, food, bio-related, structural, information and communication technology (Ministry of Education, 2006). To develop a broad technological literacy, students are expected to experience and explore a range of historical and contemporary examples of these technological areas in a variety of contexts.

2.3.1 Underpinning Ideologies

Unlike previous technical education that focused on the mastery of material skills to develop products with high 'take home value', technology education emphasised the need for students to bring together a range of knowledge, skills and capabilities, and embed them in a sociocultural context when developing products and systems that improve on those which already exist (Compton and Harwood, 2000). For a student's product and/or system to be considered 'fit for purpose' in technology, not only do they need to perform to a 'communities' expectation but the technological practice undertaken to create it also needs to abide with the customs, social and cultural constructs of the 'community' in which their practice is situated. As such, technology education positions itself as being far more ambitious than earlier skill and design focused technical education curricula. The aim of technology education, as described initially (Ministry of Education 1995) and in the revised curriculum (Ministry of Education, 2006) is to support the overall development of students' technological literacy. This development of students' technological literacy aligns technology education in New Zealand to an 'education for citizenship' position (Zuga, 1989; Print, 1993; Beane, 1998). It focuses on the development of a liberating, empowering and critical general literacy for all, to ensure that the nature of this citizenship is democratically aligned (Davies, 1998; Petrina 2000; Compton and Harwood, 2003 & 2005; Kierl, 2006). This is fundamentally opposed to earlier stances in technical education which sought primarily to educate a certain sector of the community for vocational/domestic reasons – often through replicating practices from the past (Compton and Harwood, 2003).

Technology education in New Zealand draws from both sociocultural and constructivist learning theories (Compton and Harwood, 2004) to support a combination of predetermined and situation embedded

2.3.2 The Nature of Student Learning and Implications for Pedagogy

Under a combined sociocultural and constructivist learning theory approach, the nature of student learning is embedded in becoming knowledgeable and competent in ways currently validated by experts, alongside being able to explore personal potential and creativity in informed and socially transformative ways. Developing a technological literacy in keeping with such learning allows students to make informed projections into potential future practices that step outside and/or push boundaries of their current practices or those which have traditionally been accepted (Compton & Harwood, 2003). Allowing opportunity for all students to develop such technological literacy, therefore, has inherent implications for the sorts of pedagogical practices that teachers adopt, as well as the learning contexts that they provide for their students.

To enable students to develop a technological literacy that is *broad deep and critical* in nature, students need to be provided with a balanced teaching and learning programme that integrates all three strands, but may offer learning experiences that focus on one or two of these strands at a time (Ministry of Education, 2006). Essential within such programmes is an opportunity (and teacher encouragement) for students to employ diverse and creative practices that explore a range of values, ethics and attitudes, as well as provide opportunity for students to participate in individual and group technological activity. Teacher pedagogical practices for technology therefore need to focus on supporting both predetermined learning intentions as well as negotiated student/teacher intentions that are responsive to the needs of the students and the specific work they are undertaking.

In establishing learning environments for technology that are underpinned by sociocultural and constructivist approaches to learning, teachers can provide the necessary structure and timely intervention(s), to ensure that student learning occurs. Planning for and assessing student learning in technology education therefore, should be "…seen as interactive, dynamic and collaborative. Rather than an external and formalised activity, assessment (in technology) should be integral to the teaching process and embedded in the social and cultural life of the classroom." (Gipps, 1999, p.26). As such, assessment of student learning in technology should be an ongoing integral part of the design and its delivery of classroom curriculum, rather than being presented to students as a post-learning isolated event (Hattie and Jaeger, 1998; Shepard, 2000).

3.0 CONCLUSION AND RECOMENDATIONS

From the discussion above it can be seen quite clearly why teaching technology in New Zealand is so 'hard' for teachers who have historically been trained and employed to teach within a technical education framework. This group of teachers is dealing with a significant shift in purpose (from vocational/social replication to general education/technological literacy for citizenship) and pedagogy (from behaviorist-based practices to a sophisticated mix of sociocultural and constructivist-based practices). We believe the nature and extent of this shift has been poorly articulated in the past and has resulted in many members of this teaching community feeling increasingly disempowered within the technology education community. This is a situation technology can not afford to ignore.

Just as contemporary technological practice requires collaboration between a range of experts, the revised technology curriculum will require collaboration between a range of teachers with diverse backgrounds if it is to be successfully implemented. Teachers from technical backgrounds are a key part of a successful technology teacher team. They bring a wealth of knowledge and skill to support practical endeavours that are central to technology education. The *need* for the development of specific knowledge and skills is one aspect that has in fact remained constant across the shift from technical to technology education. However, the *purpose* for learning these has undergone a change. This change in purpose reflects a shift from learning knowledge and skills for their own sake, to one of learning knowledge and skills in order to undertake informed and high quality technological practice and to underpin the development of generic technological understandings. This change in purpose does not therefore reduce the emphasis on specific knowledge and skills, but rather the revised technology curriculum (Ministry of Education, 2006) is totally *reliant* on students having access to a range of such knowledge and skills.

As indicated above, many teachers with a technical background are feeling undervalued and unhappy with the direction that technology education continues to pursue. For some of these teachers, we acknowledge there may be no desire to be a part of general education. Such teachers are not the focus for the following recommendations and all we would suggest in relation to this group is that they should not be positioned as technology teachers by schools or the wider community. For those 'technical' teachers who are however looking to develop their professional practices in line with technology education, we suggest the technology education sector as a whole has a very real responsibility to communicate effectively the valuable role they have, in the implementation of the revised curriculum, and ensure they are well supported in doing so. We suggest this will require extensive professional development if we are to realistically expect these teachers to confidently and competently teach technology. Such professional development should be nationally accessible and coherently managed to provide adequate time and ongoing targeted support by way of people and comprehensive resource materials. While it must be acknowledged that such professional development support is long overdue, for the sake of a robust technology education community that can support all students to develop their technological literacy, we hope it is not too late.

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