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The road less travelled: a pre-service approach towards the technology teaching profession

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Abstract This paper presents the findings of a longitudinal study on the effectiveness of an innovative one-year pre-service Graduate Diploma of Teaching (secondary) for teachers of Technology. The timing of this study is significant. Over a decade of review and adjustment to the Technology curriculum, leading to the new learning area of Technology in the New Zealand curriculum, Ministry of Education (2007), has caused many teachers in New Zealand schools to retrench to an earlier approach or make their own interpretation of curricular requirements. This situation in schools created the need for those involved with pre-service teacher education to prepare programmes that signpost pitfalls while building on students' own strengths and those of the curriculum to cope with the wide variety of interpretation and pedagogical approach of school communities. This paper suggests a way forward.

Keywords Communities of practice · Creative design practice · Student-centred · Brief-centric · Authentic practice · Personal construct · Co-construct

Two roads diverged in a wood and I – I took the one less travelled by, And that has made all the difference
Frost (1916)

Introduction

Technology is a complex, fluid and changing area of concern, and finding an acceptable definition is problematic, if not impossible. De Vries (2005) turns to the broad field of philosophy to establish a *philosophy of technology* to underpin education for technology. He sees *ontology* dealing 'with being, with what is, what exists' as especially relevant

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because it questions 'what makes technology different from nature?' (p. 3). Further relevant inclusions from the field of philosophy are *methodology* (the way in which something is achieved), *metaphysics* that 'deals with our visions on reality, and the way we try to make sense of reality' and a related element *teleology* that looks at the motives driving mankind and its technologies. It would also seem essential that study of the nature of knowledge or *epistemology* inherent in the broad domains of technology should underpin all learning. De Vries (2005) also includes '*ethics* and *aesthetics'* (p. 5), to contribute the human values component towards a robust philosophical support base for this learning area. Hence, formulating a convincing and credible rationale for education within and about technology. Williams' (2009) research validates this philosophical basis when observing the nature of technology education programmes. He highlights the need to develop an awareness of the 'confrontational relationship between technology and the social and physical environment' proffered through 'media, politics, and increasingly individual lifestyle choices' (p. 534). He proposes a

> Technology teacher education programme that focuses on developing an …informed knowledge base from which to critique technological and social developments, and the practical mechanisms through which students can develop a form of technological literacy (p. 535).

If we identify with a wide-ranging view of technology education, technology teacher education needs to be equally wide ranging and flexible, not least because of continual changes in our complex society and environments. When Spendlove (2008) speaks in enthusiastic terms of the 'unique form of empowerment and learning' young people develop through this field as they 'engage in processes that challenge them in high-level thinking and decision making,' where they consider 'values and emotions through rich and stimulating contexts' (p. 4), he is also implicitly arguing for a flexible and wide-ranging curriculum. Further, we need to be aware of (and we need to respond to) the various perspectives and experiences of people choosing to enter the teaching profession from wide-ranging technological communities of practice.[1]

Background

The implementation of Technology programmes in New Zealand secondary schools remains in a state of differential settlement.[2] Frequent Ministry level changes to the structure and intent of the learning area have required schools and teaching staff to make frequent adjustments. In consequence, there is a general lack of understanding, resistance to further change and little coherence across school communities nationwide. Indeed, school programmes tend to reflect school-wide, departmental or individual teacher interests, levels of understanding and expertise. Many school programmes have reverted to the skill-based learning approach employed prior to the introduction of *Technology in the New Zealand curriculum*, Ministry of Education (1995), while others are presenting arid programmes of work requiring students, for example, to research planning techniques for 3 months prior to designing their projects. Such an approach is reflective of the nationwide

[1] Communities of Practice are seen by Wenger (1998) as those where three key dimensions of mutual engagement, joint enterprise and shared repertoire are present.

[2] Differential settlement—an engineering term relating to an uneven or substandard substrate that bears a structural loading causing variations in the support and stability of the load.

trend noted by Williams (2009) that 'technology is sometimes included in school programmes simply because of the literacy or numeracy competencies it can promote' (p. 527). It turns its back on the rich learning potential of classroom practice that reflects communities of practice, and seeks learning in authentic contexts through experiential learning.

Regardless of interpretation and acceptance issues, the learning area of Technology is a compulsory part of our curriculum for students up until Year 10 (age level 14) and pre-service teacher education programmes need to help student teachers cope with the complex and uncertain situation in schools. The key question is: how?

Making the most of diversity

In the middle of difficulty lies opportunity—Albert Einstein

Increasingly a large proportion of student teachers enter the pre-service programme teacher from the field of creative design practice. We have observed that the role of the human driver and decision making at the core of creative design and technological practice is second nature to these students. They are able to acknowledge and adapt to the variety of school interpretations of curriculum and find a pathway that encompasses the school approach without losing confidence or sight of the real learning area intent. Their strengths lie in their ability to look at each situation with its many and varied conditions; as one requiring a solution. They are able to use to creative design thinking to face the challenges and deal with the problems of their new teaching careers in ways that mainstream students (without their career experiences) often cannot. It is our contention that we need to build in all beginning teachers a degree of confidence in their own abilities developed through an indepth, working understanding of a career within a community of practice to enhance classroom practice. The suite of courses that constitutes our programme has been developed to address the real needs of pre-service teachers in the transition stage from a specific community of practice to that of the Technology teaching profession. Our approach, built on years of classroom and lecturing practice, is based on a design brief-centric approach that models communities of creative design practice. This is a mostly untrodden and unacknowledged pathway in New Zealand teacher education. Whereas Design is an implicit, even driving aspect of the technology curriculum in England and Wales. New Zealand elected not to take up the full title of *Design and* Technology at the initial stage of curriculum reform, thus disenfranchising the role of creative design thinking at the core of technological practice. In stark contrast, my view is that the role of the designer or perceptive decision maker is fundamental to creative design and technological practice. Pavlova (2006) reminds us that the designer constantly weighs up positive and negative consequences of design decisions on 'human beings immediately or indirectly' and that this is an essential criterion at the core of a 'professional action' (p. 27) While De Vries (2005) emphasises the important part that *ethics* and *aesthetics* play in the 'decision-making aspect of technology' and that they 'should have a proper place in the teaching about technology' (p. 102). In other words designers develop a working familiarity of the human interface with its environment in all of its guises. It follows that career training and experience in this field provides a firm foundation for our students to comprehend, assimilate and eventually implement curriculum and Technology learning area requirements. From the standpoint of creative design practitioner, students are able to see recognisable applications for the Technology

learning area philosophical core statements and can readily translate curricular intent through experiential learning into informed, student-centred, classroom practice. These students also find that they can confidently take part in the ongoing curricular and programme debate from an informed position. Further, we have noted that progressive schools view students who are embued with a strong creative design ethic as messengers to inform contemporary programme planning and practice, although such schools are few. Most school departments are pre-occupied with coming to terms with the densely worded Technology learning area's theoretical demands and assessment requirements to lift their attention to a fresh alternative perspective.

The current programme

> If indeed we do teach as we were taught, then many 'new technology teachers' will tend to organise and teach their own courses using models similar to the programmes they followed in their pre-service training p. 23.
> (Hansen & Lovedahl 2004)

The philosophy underpinning our preservice programme is strongly linked to a constructivist and inquiry-based approach. We believe that the programme not only prepares teachers for teaching the pragmatics of the curriculum, but also concentrates on building a student teachers' own persona as a teacher. As Williams (2009) notes; 'It would seem that teachers should begin their career having developed a deep personal understanding of themselves as teachers, and their training must have this as a focus' (p. 534).

The nature of the immediate environment plays a significant part in the development of a creative community. A room is set aside to encourage creative debate and responses as a comfortable design hub adjacent to specialist, multi-material and process workshops. Comfortable seating invites students to return to this space between lectures as a home base, immediate internet access and wall displays inspire and promote creative thought for current students and model an approach to emulate in future classrooms. Within this environment we work to achieve a mentor-protégé-facilitator relationship that provides an emotionally supportive environment that values students' previous career and life experiences. This approach develops pre-service teachers' confidence, beliefs, values and practices. Bova and Phillips (1984) note that mentoring relationships have an essence that is both emergent and transcendent and 'are critical for developing professionals in higher education' (p. 8). As noted earlier, students enter the programme of study from a career or after gaining qualifications where they have been steeped in a particular community of practice. The diverse range of student career backgrounds include architecture (commercial, domestic and naval), engineering (civil, structural, mechanical, electrical, electronics and sound) food, hospitality and nutrition, textiles, information technologies, project management, computer science and programming, trade areas such as building construction, boat building, precision engineering, landscape, interior, visual arts and contextual studies, spatial, stage-set, product, fashion, film, animation and graphic design. This combination of specialist career expertise provides for rich discussion around the question 'What is and isn't technology? and cross fertilization of ideas as the training year progresses. Valuing students' career backgrounds helps to maintain confidence and builds conceptual bridges to educating about technology and the development of technological

literacy.[3] The programme design has the development of the individual at its core, with each year's intake presenting a unique composite of skills, tacit knowledge and personal attributes. Development focuses on an evolving personal construct, where gradual shifts in perception occur in a learning environment that encourages and models self-reflection and, as Clarke and Hollingsworth (2002) propose, 'enaction'—where 'each action represents the enactment of something that the [student teacher] knows, believes or has experienced' (p. 951). Critical analysis and in-depth dialogue prompt the individual and the larger group to construct, co-construct and re-construct new understandings about technology and the way we understand and interact with our world. Learning is supported by readings of seminal and contemporary research findings. Links with communities of practice are encouraged and fostered in an attempt to construct an informed and robust, communal technological literacy. Although some students have poorly developed constructs of the nature of technology and Technology education (McRobbie et al. 2000), these initial perceptions provide a fertile ground to build in-depth dialogue towards the co-construction of cohort and individual understanding.

Our belief is that the person who performs the role of teacher, and their understanding of the social contexts in which they teach, are as crucial to teacher effectiveness as the mastery of content knowledge and pedagogical techniques. Hence, we model by generating authentic learning experiences, thereby acknowledging one of Dewey's (1897) seminal decrees that 'education is a process of living and not a preparation for future living' and that all learning 'must represent present life—life as real and vital' to the learner (p. 3). Student-selected design briefs evolving from individual, national or global issues that affect directly or indirectly their own lives, initiate student learning experiences. Creative design thinking, knowing and methodology provide the matrix that connects specialist areas of technology, and aligns learning experiences to Technology curriculum requirements.

From the onset our course employs pertinent questioning, to instigate in-depth discussion and modelling that convert ideas and reflections on research findings and students' own practice into potential classroom experiences. In their work to instil multicultural awareness in pre-service teachers, Gay and Kirkland (2003) explain a similar approach where techniques that look at 'converting knowledge from one form to another, …sharing with others, and receiving constructive feedback,' provide a valuable lesson in reflexivity[4] and critical consciousness' (p. 185). Students unfamiliar with the practice of self-reflection can view the process as merely 'describing issues, ideas and events; stating philosophical beliefs; or summarizing statements made by scholars.' These students, however, miss 'the analytical introspection,' that is 'an essential element of self-reflection' (Stronge, 2002, cited in Gay and Kirkland 2003, p. 182). All students are guided through modelling of pertinent questioning and thinking strategies to develop an in-depth reflective habit that remains a core element of their professional practice. We further concur with Gay and

[3] In the NZ curriculum Technology has three strands—Technological Practice, the Nature of Technology, and Technological Knowledge. According to Compton and France (2006) when "studied together…these three strands should provide students with experiences …within which they can develop a deep, broad and critical technological literacy." (p. 12).

[4] Reflexivity is an act of self-conscious consideration that can lead people to a deepened understanding of themselves and others, not in the abstract, but in relation to specific social environments…[and] foster a more profound awareness of how social contexts influence who people are and how they behave. It involves a person's active analysis of past situations, events, and products, with the inherent goals of critique and revision for the explicit purpose of achieving and understanding that can lead to change in thought or behaviour (Danielewicz 2001, pp. 155–156).

Kirkland (2003) that such practice also builds camaraderie within the cohort while providing intellectual clarification and confirmation as students confront philosophical and educational issues in a supportive, collaborative manner.

The first assignment requires students to visit an industry or community resource of their choosing, to become familiar with the complex nature of the enterprise. They view the practice after having been introduced to literature that provides a viewpoint on the structure and extent of activities, culture and organisation within contemporary industry or resource practice. For example, Natalia's (pseudonym) focus on a honey manufacturing industry addressed the company's vision and goals ('Healing as nature intended'), the historical underpinnings and systems needed to maintain company values, views on sustainable practice, management structure, guiding codes of practice and ways to 'future proof' the organisation and maintain consumer confidence. In addition to these findings students acquire an in-depth understanding of product development and marketing. All students report that this kind of experience makes tangible links between theory and practice, often providing valuable community links to inform or support future classroom practice. Students prepare a formal digital presentation to their peers on their findings, with links made to the curriculum and implications for teaching practice. The presentation becomes a valuable resource to provide evidence of technological practice for teaching. Subsequent assignment work requires students to identify a real need based on a problematic or contentious issue in their or another client/stakeholder's lives. The intent of this assignment is to model and record design/technological practice to mirror that of the community or industry. Each journey of practice is unique—for example, a device to make riding a bicycle safer in city traffic or instant housing for people made homeless through a natural disaster. This work is presented to a professional standard with unit (long term) and lesson (short term) planning accompanied by prepared resources to be assessed at the end of the course and to become an important part of each teacher's resource bank. All evidence of practice is design brief-centric and student-centred, with open access to multimaterial workshops as required. Full documentation in dialogic journals verifies links to required and self-sourced readings, research, specialist links to communities of practice, curriculum and technology learning area focus points. In-depth personal dialogic journals house the immediate capture and manipulation of design thinking, idea generation and relevant research. The use of a journal is second nature to students who hail from creative design practice careers such as spatial, product, graphic, digital and fashion design. Throughout the pre-service year all students (including those from science, engineering and foods career backgrounds) adopt the journal approach, recognising its relevance in their own and future school students' development.

The final assignment task is a personal statement that reflects on and substantiates findings, shifts in thinking and the development of students' own teaching persona, reinforced by statements from seminal literature on pedagogy and educational philosophy related to the technology.

In summary, our goals in guiding career-changing specialists to build understanding, confidence and flexibility as effective teachers of Technology have identified six key elements:

- To assist pre-service students in recognising, respecting and trusting in their own and other students' tacit knowledge.
- To help build a construct about technology and why the learning area of Technology has a place in the New Zealand curriculum, and to encourage a working understanding of the structure of the curriculum in the context of classroom practice.

- To encourage a critical consciousness approach towards the personal, professional and societal implications of their new constructs, based on the perceptive decision maker (designer) at the core of their practice.
- To assist in the transition from specialist practitioner to developing teacher persona.
- To debate standardized formative and summative assessment measures, with an awareness of individual creative potential and its lack of recognition by many assessment measures.
- To record and reflect on students' changing perspectives and interpretation of current and seminal literature for their future in teaching and to encourage their own life long learning.

Research methods

To ascertain the effectiveness of this pre-service programme we have examined student perceptions of technology and their understanding of the learning area of Technology in the 2007 New Zealand Curriculum at key stages of the programme. We have also reviewed beginning teachers' levels of confidence in teaching Technology on exiting the Faculty of Education and after their first and second years of teaching.

Our research utilized a mixed methods approach, which Creswell et al. (2003) refer to as 'Sequential Explanatory Design.' It comprises two stages: first, collecting of quantitative data; second, collection of qualitative data to help explain the quantitative results. The quantitative data gathered from a large group of our pre-service student at set times in their training, provide rich statistics on the perceived effectiveness of pre-service education and the student teachers' levels of confidence in teaching Technology, while the qualitative data provide in-depth explanations for the patterns identified in the quantitative data. Each interviewee has selected a pseudonym for use in this paper.

All end-of-year graduating pre-service students in the Graduate Diploma of Teaching (Secondary) programmes were asked to complete an anonymous questionnaire after course completion in order to ascertain their perceptions of how well the course had prepared them for teaching. After initial data analysis of the first questionnaire, self-selected participants were interviewed to explore issues and trends emerging from the data. The same participants have been interviewed towards the end of their first and second years as provisionally registered teachers (PRT[5]). The process not only seeks to identify the level of effectiveness of the pre-service programme but also looks at in-service technology programmes that support beginning teachers in schools.

The questionnaire, prepared to address both primary (junior) and secondary (senior) pre-service teachers, has 4 sections. The first 12 questions relate to student teachers' understanding of the Technology learning area of the 2007 curriculum. This is followed by 5 questions focussing on student teachers' preparedness to teach Technology and 4 questions related to their confidence to plan and assess Technology in schools. The final section comprises 5 questions with a purely secondary (senior) focus. Responses were recorded on a 6-point Likert scale (very poor, poor, slightly good, good, very good, excellent). Interview questions at the time of course completion prompted reflection on the nature of the

[5] Pre-service postgraduate teacher training in New Zealand comprises a three-year period of provisional registration. The first year is a year of study; the second year requires employment as a teacher on an 80 % workload; the final year of training requires a full teaching load with other school community responsibilities. Teacher registration is gained with the support of school senior management at the end of this time.

pre-service year. Self-selected interviewees were asked about their feelings of preparedness for the coming teaching year, specifically those aspects of the course that contributed to their feelings of preparedness and those that could have been improved. As many as possible of these participants were interviewed at the completion of their first and second years of teaching. They were asked to compare the realities of teaching in the Technology field with their expectations on exiting the year of study. They were asked about in-service support they had expected and received (or not) and the nature of this support. They were asked, in hindsight, to offer suggestions to inform our pre-service training year. Interviews were recorded with the consent of each participant and transcribed to provide the qualitative element of this research.

The findings

Questionnaire responses overall during the 3 years of this research have shown an increase in student understanding of the core philosophical principles that underpin the learning area of Technology. Most feel confident in their own understanding and ability to plan and teach the *Technological Practice* strand and its three components; Brief Development, Planning for Practice and the *Nature of Technology* strand and its two components; Characteristics of Technology and Characteristics of Technological Outcomes. They could understand and implement the *Technological Knowledge* strand and its components, although a number wished to further debate the narrow focus of the three identified components of this strand being the understanding of Products, Models and Systems. The majority of participants felt that the required readings contributed to their understanding of technology and the learning area. Many felt that our approach helped them to form links between theory and practice, while most felt that it had given them confidence in their own ability to provide learning environments that would encourage authentic learning experiences capable of developing tacit understandings through experiential learning for their students. They all felt that they were exposed to a range of appropriate assessment strategies during their year of training and believed that they would be able to utilise 'The Indicators of Progression'[6] to assess learning in junior technology classes. They also felt confident about being able to use the NCEA[7] Achievement Standards at senior levels of learning.

Many student teachers from the 2008 cohort[8] stated that they learned much from in-depth discussion and debate with student colleagues supported by the lecturers' modelling of effective classroom practice. Recent interviewees concur with these sentiments, speaking with respect of their cohort friends (who came to teacher training from vastly different career backgrounds) and the high calibre of the content and presentation of their assignment work. There was a feeling of mutual respect and support across the cohort that had nurtured a creative approach and level of understanding that boded well for this learning area. Many said that they intended to maintain the cohort support through regular

[6] *Indicators of Progression*—developed initially as a means to gauge a learner's progression through levels of learning. They now provide guidance to programme content and planning at all levels of learning http://www.techlink.org.nz/curriculum-support/indicators/index.htm.

[7] National Certificate of Achievement—New Zealand's achievement based assessment system, introduced at level 1 (age 15 years), final level 3 with scholarship (age 17 years) http://www.nzqa.govt.nz/qualifications-standards/qualifications/ncea/.

[8] Responses and findings from the 2008 cohort have been presented in a previous conference paper (Wells and Mc Glashan 2010).

meetings and most felt that they had become 'life long learners' keen to encourage the same of their future students.

At the end of their 2 years of teaching the first cohort (2008) students' observations included comments about the Technology learning area requiring a great amount of paper work and research, with little time for design thinking or skill development. Some mentioned that curriculum requirements around the Technological Knowledge[9] strand components of Products, Models and Systems that do not recognise other knowledge embedded in practice such as the broad knowledge base of design practice. However, most found that by planning and implementing rich learning experiences that were set in the context of students' and their own interests, resulted in student enjoyment and engagement.

The four self-selected graduating interviewees from the second (2009) cohort ranged from background careers in Computer Graphics, Engineering, Food/Hospitality, Fashion, Graphic and Product Design and Performing Arts. They all felt that they had a sound understanding of the Technology curriculum statement and the philosophy that underpins the learning area. Most were feeling confident as they looked forward to their first teaching placements. However, Natalie was typical of those who noted the different interpretations to teaching technology that she encountered on her teaching practice:

> *'I think that I have a really good understanding of it* [the NZ Curriculum, Ministry of Education (2007) Technology statement.] *I have seen quite different practice on practicum but I think from what I've been taught and my own understanding, I'm pretty confident to go into a school and implement it.'*
> Natalie's response about her readiness to teach is very positive: 'because I feel that through the training I've had enough examples and practice of writing units that I could get into a classroom and facilitate the learning for my students in accordance with the curriculum.'

When asked which elements of the course helped them feel most prepared to teach, most nominated the lectures, assignments and examples of theory set in practice through experiential learning, where problem-solving activities based on an actual need of their own made their learning relevant and established a tangible link to classroom practice. Asha noted that assignment projects often caused her to step out of her comfort zone in a way that tested yet empowered her. Anna noted the modelling of best classroom practice and stated that she enjoyed her technology training because *'its really relevant to my teaching subjects and the lecturers guided us so that everything we got taught was modelled to be like a teacher* [with a class] *whereas my other course weren't like that.'* Anna also referred to classroom modelling in noting the relevance and assistance the assignment work had in preparing her to teach where sh*e* 'actually did them as if I was the student or…did the unit of work planning to include the assessment achievement standards as if I was a real teacher. It was practice before I had do it in a real school with the benefit of feedback from the lecturers.'

All voiced their feelings of uncertainty with aspects of technology curriculum documentation, such as the relevance to their future students of *Indicators of Progression* at the senior levels of learning, especially those written in the areas of their career background where they had some currency.

[9] Compton and France (2006) see the Technological Knowledge strand as being focused on developing key concepts of technology that are generic to all technological endeavours. Key ideas are restricted to technological modelling, products and systems.

Findings of 2009 cohort interviews at the teaching registration stage of PRT

In 2010 the entire 2009 cohort was invited to attend an evening meeting to share findings of their first year of teaching and participate in a collaborative interview. Seven interviewees attended, both researchers were present to guide the discussion with prepared questions. Participants were pleased to see each other but were somewhat subdued in comparison with their enthusiasm at the interview immediately prior to their first teaching year. One further participant was interviewed on a separate occasion.

When asked to reflect whether the pre-service programme had prepared them for teaching, responses include:

> You built us up with an understanding and skills that we started teaching with, these keep me from falling into the administration and theory rut. (Asha)
> We were trained to follow a strong pathway and I don't want to change my philosophy, I will continue trying to push towards achieving what we covered in class and hopefully everyone else will eventually catch up. I hope that it [our taught approach] will be valued out there. I wondered if it looks as if we have come up with new fandangle idea that the oldies can't relate to—we're going to push the oldies along anyway. (Nina)

When asked if we could improve any aspect of our course (Asha) responded: 'I have struggled with assessment. I would have appreciated actual practice where we assess work and you critiqued and gave feedback on our efforts, I would like to have moderated work with you guys.'

Several felt that the *Indicators of Progression* terminology was hard to interpret and set at a higher level than actual levels of student of capability and achievement. These observations were made from a position of former career expertise. Another felt that she would have appreciated entering the teaching profession with a set of simple 'Do now' activities and student-friendly resources to raise the level of student critical thinking. Most found that 'there are few up to date resources in the school and once you begin teaching there is little time to prepare.' (Sara)

When asked if they left our programme with a positive feeling of confidence towards their teaching career, they all responded in the affirmative. When asked if this feeling has endured, responses include;

> For me no, I was more positive at the end of last year. (Fran)
> *It has killed my* [initial] *expectations, I went in thinking that I will get them all through, they will achieve, but I've had to change my ideas a lot. I became a little lost. (Sara)*
> My expectations are so different [from reality]. I thought that kids could do so much more, having been a designer/technologist, familiar with processes I thought that kids would want to run with it, but they don't. (Asha)

When asked if they noticed a change in pupil motivation as they progress through to older levels, one responded that her senior students work hard because they want to achieve assessment credits whereas junior classes don't have that incentive, so are hard to engage. These participants also noted the stress for themselves, staff and senior students meeting assessment requirements and that it takes over when trying to maintain a focus on student-centred learning. Although they remained intent on providing learning experiences that engender ownership for their students, to encourage engagement and creative response. Nina finds the hardest part of her teaching is the gathering of evidence for assessment. She

notes that her students *'have to write so much to record their practice, they can be working through in-depth practical stages* [of their project work] *where they can show you and speak about what they are doing, but they have trouble in documenting their practice. These stages could be recorded differently such as through video or photographic evidence. I find getting anything written in portfolios so hard and yet they have carried out full practice. I am concerned that the high school system seems to reward students who can express themselves on paper rather than those who communicate differently.'*

When asked about the nature of their school technology teaching programmes, one noted that students chose the subject Hospitality (an industry-run and industry-assessed skill development course) rather than Food Technology as it requires a large written element. A number noted that little timetable space is given to Technology in senior levels of learning.

Peter had entered the pre-service programme from an engineering career background. In his first year of teaching in Technology has followed a predetermined course in an engineering workshop to meet the requirements of Industry[10] training standards, where he has taught pre-prepared course material on trade health and safety and supervised workshop use. He taught the design and making of a product, with health, safety and workshop procedures at Level 1, (15 year old students). At Level 2 he taught trade calculations, mechanics and materials for the first part of the year and spent the second part of the year supervising trainees in the engineering workshops. The work achieved in the year was assessed through Unit Standards prepared by an Industry training organisation. However, Peter was able to teach the same set generic technology programme to four junior classes and noted that the repetition 'has been great for reflection and refining the course.' He is feeling positive about his future in teaching generic technology, as he has managed to attract three Year 10 (14 year old) classes of students to return to the subject as an option class in the following year. However he commented on the restrictive school approach, however, by noting that 'you can't do a lot of brief development because the students are given a piece of wood to a specific size and that's it.' When asked about the status of the subject Technology in the school, Peter noted that 'senior management have the opinion that technology is engineering, construction or the old Home Economic trades based training, or where the naughty kids go.' He noted that only three girls remained in his senior engineering classes. All three were fantastic although none were continuing because they needed to achieve good grades in other subjects in order to gain admission to tertiary courses.

When asked if the reality of teaching technology aligns with the emphasis of the pre-service programme, he noted that the school was developing its own approach that differed from ours. He thinks 'that teachers and schools have tried to keep up with all of the changes over many years in technology and that teachers are voting for stability and making their own choices until everything settles down.' Teachers with whom he works note that their students 'don't enjoy much of the writing required by the subject now and it turns them off learning.' When asked if there was anything we could have done differently to help him in his first year of teaching he responded; 'I understood the generic way of the technology learning area and how to write units of work and even to some extent assess using standards-based assessment from the training year. However, I was not prepared for the completely different industry training programmes and assessment which makes my meeting with a moderator tomorrow very difficult.' When asked what he found helpful in

[10] Courses offered in New Zealand high schools that offer specialist training in the trades prepared and assessed by Industry Training Organisations.

the pre-service year, he responded: 'I look through my journals and resources that you gave us for ideas. I really enjoyed the practical lessons, the class discussions, especially learning from my class mates as they shared aspects of very different career backgrounds and their practicum experiences.' He concluded with an observation that 'we were trained to be technology teachers and we walked into very varied teaching environments with very different understandings of the curriculum, and we have to become familiar with whatever their programme dictates. Because we are learning so much in our first year we have to tread their beaten track.'

The majority of the group interview participants have taught in low decile[11] co-educational schools, where they have found conditions quite different from their expectations. Nina said that her school's senior management were attempting to implement the New Zealand curriculum (2007) and Professional Development sessions were held at regular intervals to inform all teachers about each curriculum learning area. Encouragingly, Nina was consulted as someone with a contemporary perspective of the technology learning area. She has also been encouraged in collaborative programme planning with '… no restriction to try something new, they were willing to share ideas.'

Concluding statement

It has been most encouraging and heartening to witness the development of the teacher persona and voice coming through over the time span from graduand to registered teacher. Even in an uncertain climate of vastly differing acceptance and implementation approaches to the learning area of Technology in schools, most of our students are able to adjust and adapt to what they find. We regard this as significant justification of the approach we have adopted in our pre-service programme. Many graduands of the programme have had to overcome disappointment at the lethargy and lack of interest in learning in some school communities, although this seems to be indicative of student, parent and school expectations across all subjects. In many cases, these new teachers feel that they are treading water until they can prove themselves worthy of inserting some of their own ideas into an existing and often seriously out-dated programme. However, we see our graduands finding considerable strength to take into teaching from their feed-in community of practice, especially the designers who seem able to regard the often restrictive situation in school Technology departments as a problem to be solved. They work in a way that is cognizant of the entire situation and needs of the people involved to create an acceptable place for themselves and their students alongside their teaching colleagues. Beginning teachers who address their teaching roles from a background in active problem-solving can hark back to a familiar approach to find a way forward.

Most of the students have maintained the personal construct of the learning area of Technology and its underlying philosophy built up during this course. They hold a broad intent to engage and empower their pupils. However, all have needed to walk the way of their school's interpretation of Technology until they are in a position to implement change. Although very few have, as yet, been able to contribute to junior class programme planning, two new schools have recently employed our students to *lead* departments after their pre-service training year.

[11] Decile rating refers to the socio- economic status of the school community using a scale of 1–0, with 1 indicating low and 10 a high socio-economic level.

This research confirms our belief in the need to assist student teachers in building their own construct from the core intent of the Technology learning area and to affirm and value their own prior learning, career experience, skills and understandings. As noted earlier, we aim to build within each group a community that is supportive, open to discussion and flexible in its acceptance of the unfamiliar; we guide our students by modelling best classroom practice in workshop and design environments that encourage a creative approach to problem solving. This research confirms our confidence in this approach. Interview findings, however, require continuous adjustment to our programmes including developing a tool kit of settling 'Do now' activities and strategies to encourage ongoing dialogue and reflection to enhance school student evaluative comments to describe and justify their practice.

We have recently established a series of meetings with former students in order to continue the support network and unofficial dialogue after they have been employed as teachers, in the hope that their light of enthusiasm remains shining brightly well into their teaching careers. Many have set up and maintain Facebook dialogue.

Our hope is that in time a nationwide balanced interpretation of what is potentially the most important subject in the curriculum, that sets all other learning in context, will emerge. This will require simplification of learning area documentation and considerable informed professional development programmes to guide holistic, authentic, student-centred learning that reflects creative communities of practice.

References

Bova, B. M., & Phillips, R. (1984). Mentoring as a learning experience for adults. *Journal of Teacher Education, 35*(3), 16–20.

Clarke, D., & Hollingsworth, H. (2002). Elaborating a model of teacher professional growth. *Teaching and Teacher Education, 18*(8), 947–967.

Compton, V. J, & France, B. (2006). Discussion document: Background information on the new strands available at http://www.tki.org.nz/r/nzcurriculum/draft-curriculum/technology_e.php.

Creswell, J. W., Plano Clark, V. L., Gutmann, M., & Hanson, W. (2003). Advanced mixed methods research designs. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioral research* (pp. 209–240). Thousand Oaks, CA: Sage.

Danielewicz, J. (2001). *Teaching selves: Identity, pedagogy, and teacher education*. Albany, NY: SUNY Press.

De Vries, M. (2005). *Teaching about technology: An introduction to the philosophy of technology for non-philosophers*. Dordrecht, Netherlands: Springer.

Dewey, J. (1897). My pedagogic creed. *The school journal, LIV*, (3), (January 16, 1897), pp. 77–80.

Frost, R. (1916). The road not taken. *Mountain interval*. Capital Leadership Academy. Retrieved June 6, 2011, from http://deltataudelta.pbworks.com/f/PARTICIPANTinsidepages.pdf.

Gay, G., & Kirkland, K. N. (2003). Developing cultural critical consciousness and self-reflection in pre-service teacher education. *Theory into Practice, 42*(3), 181–187.

Hansen, J. W., & Lovedahl, G. (2004). Developing technology teachers: Questioning the industrial tool use model. *Journal of Technology Education, 15*(2), 20–32.

McRobbie, C. J., Ginns, I. S., & Stein, S. J. (2000). Pre-service primary teachers' thinking about technology and technology education. *International Journal of Technology and Design Education, 10*(1), 81–101.

Ministry of Education. (2007). *The New Zealand curriculum*. Wellington: Learning Media. http://nzcurriculum.tki.org.nz/Curriculum-documents.

Ministry of Education. (2007). *Indicators of progression*. Retrieved June 6, 2011, from the Ministry of Education Web site: http://www.techlink.org.nz/curriculum-support/indicators/index.htm.

Ministry of Education. (1995). *Technology in the New Zealand curriculum.* Wellington: Learning Media. http://www.tki.org.nz/r/technology/curriculum/contents_e.php.

Pavlova, M. (2006). Comparing perspectives: Comparative research in technology education. In M. de Vries & I. Mottier (Eds.), *International handbook of technology education: Reviewing the past twenty years* (pp. 18–32). Rotterdam: Sense.

Spendlove, D. (2008). *100 ideas for teaching design and technology*. London: Continuum Intl Pub Group.
Wells, A., & Mc Glashan, A. (2010). Road to employment: Trainee teachers' perception of their pre-service technology education courses. In: *Technological learning and thinking: Culture, design, sustainability, human ingenuity* conference at the University of British Columbia, Vancouver, June 17–21, 2010. Proceedings available online http://www.learningcommons.net/.
Wenger, E. (1998). *Communities of practice: Learning, meaning and identity*. Cambridge: Cambridge University Press.
Williams, J. P. (2009). Teacher Education and Professional Development. In A. Jones & M. de Vries (Eds.), *International handbook of research and development in technology education* (pp. 525–529). Rotterdam: Sense.