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**Off the beaten path:
Programme planning for effective pre-service teacher experiences**

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Abstract

This paper presents the findings of a longitudinal study on the effectiveness of the one-year Graduate Diploma of Teaching (secondary) pre-service training of teachers of Technology. The timing of this study is significant. Twelve years of review and adjustment to the Technology curriculum, leading to the new learning area of Technology in the New Zealand curriculum (2007), have caused many teachers to re-trench to an earlier approach or make their own interpretation of curricular requirements. This situation in schools has created the need for those involved with pre-service teacher training to adjust their programmes to cope with a variety of understandings of curriculum content, implementation styles and pedagogical differences, making their connections with school communities difficult to negotiate. This paper looks at some of those issues.

Introduction

Technology is a complex, fluid and changing area of concern, and finding an acceptable definition of it is problematic, if not impossible. Black and Harrison (1985) allude to the breadth of scope of technology, suggesting that:

Technology is a practical method which has enabled us to raise ourselves above the animals and to create not only our habitats, our food supply, our comfort and our means of health, travel and communication, but also our arts - painting, sculpture, music and literature. These are the result of human capability for action. They do not come about by mere academic study, wishful thinking or speculation. Technology has always been called upon when practical solutions to problems have been called for. Technology is thus an essential part of human culture because it is concerned with the achievement of a wider range of human purposes (p.51).

If we identify with Black and Harrison's view we soon realise that technology education and therefore technology teacher education needs to be equally wide ranging and flexible to adapt to continual changes in our complex society and environments. Further, technology education needs to take account of this reality and respond to the various perspectives and experiences of people choosing to enter the teaching profession.

Background:

The implementation of Technology programmes in New Zealand secondary schools remains in a state of differential settlementⁱ. School programmes tend to reflect school-wide, departmental or individual teacher interests, levels of understanding and expertise, but with little evidence of coherence across school communities nationwide. It could be argued that this is a direct consequence of frequent Ministry of Education level changes to the structure and intent of the learning area that have required schools and teaching staff to make constant adjustment.

Much has been written on the difficulties that teachers experienced in coming to terms with the overall change in technology education. For example, Compton and Harwood (2003) observed that students were “rarely provided with learning programmes that ensured coherent, ongoing development of their knowledge, skills and technological practice” (p. 12) - an observation supported by Jones and Moreland (2004) and Moreland, Jones and Northover (2001). Sadly many school programmes have reverted to the skill-based learning approach employed prior to the introduction of *Technology in New Zealand curriculum* (1995).

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). How then do we best prepare beginning teachers to meet the demands to teach Technology confidently and effectively, at such a complex and uncertain time?

Our own observations lead us to believe that we need to equip beginning teachers with both a strong working understanding of the core curriculum intent, and a degree of confidence in their own abilities to translate the main intent of Technology Learning area requirements into valid classroom practice. Moreover that they can confidently take part in the ongoing debate from an informed position. The students’ recent in-depth involvement in technology related careers will stand by them as they steer school programmes towards the real intent of the subject, that is, to model such practice in classrooms. Progressive schools view our students as the messengers to inform contemporary programme planning but these are few. Most school departments are too pre-occupied in coming to terms with the densely worded Technology learning area’s theoretical demands to lift their attention to a fresh alternate perspective. The situation in schools dictates astute pre-service programme planning. Further, a nationwide reduction in lecturing contact times for pre-service courses requires renewed focus on the salient components of the programme to best prepare technologically literate teachers of Technology who will be able to stand strong in the face of adversity and eventually implement change, in the time available.

The current programme:

The philosophy underpinning this programme is strongly linked to phenomenology of consciousness and perception. We believe that the programme not only prepares teachers for teaching the pragmatics of the curriculum, but also concentrates on building student teachers’ awareness of *experience* and what it brings to the learning environment, especially Technology.

The suite of courses that constitute our programme has been developed to address the real needs of pre-service teachers in the transition stage from a specific community of practiceⁱⁱ to that of the technology teaching profession. The nature and content of the courses have changed to accommodate student evaluation and ongoing research findings. We will continue to affect change to better align our students’ needs and the reality of situations in schools.

Our current approach to pre-service preparation:

Initially we work to achieve a mentor-protégé-facilitator relationship that provides an emotionally supportive environment for developing 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). Students enter the programme of study from a career or after gaining qualifications where they have been steeped in a particular community of practice. Valuing students' career backgrounds helps to maintain confidence and builds conceptual bridges to educating about technology and the development of technological literacyⁱⁱⁱ. The programme design has the development of the individual at its core. Development focuses on an evolving personal construct, where gradual shifts in perception occur in a learning environment that encourages and models self-reflection. Critical analysis and in-depth dialogue prompt the individual and the larger group to construct, co-construct and re-construct new understandings about technology. Learning is supported by seminal and contemporary research, modelling of classroom practice, and links with communities of practice in an attempt to develop an informed and robust, communal technological literacy. Although some students have deficient constructs of the nature of technology and technology education (Mc Robbie, Ginns & Stein, 2000), these initial perceptions provide fertile, initial discussion ground for in-depth dialogue towards the building 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. We model by generating authentic learning experiences, thereby acknowledging John Dewey's (1897) decree 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.6). Practical learning experiences initiated by student-selected design briefs reflect and model effective classroom practice. Design thinking, knowing and processing underpins and drives learning experiences by providing a matrix that transcends technology related communities of practice.

An initial approach employs pertinent questioning, in-depth discussion and modelling to convert ideas and reflections on research findings and their own practice into potential classroom situations. 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^{iv} 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' Gay and Kirkland (2003, p.182). They miss the 'analytical introspection,' that is an essential element of self-reflection' (Stronge, as cited in, Gay and Kirkland, 2003, p. 182). We recommend guiding students to go beyond superficial descriptive observations by modelling a depth of enquiry through pertinent questioning strategies such as the Bloom and Solo taxonomies to help them develop an in-depth reflective habit. This core element of their learning, will guide their future teaching practice. We further concur with Gay and Kirkland (2003) that such practices also build

camaraderie within the cohort while providing intellectual clarification as students confront philosophical and educational issues in a supportive, collaborative manner.

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

- To assist pre-service students in recognising and respecting 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 through experiential learning in the context of classroom practice.
- To encourage a critical consciousness approach towards the personal, professional and societal implications of their new constructs.
- To assist in the transition from specialist practitioner to a developing teacher persona.
- Debate standardized assessment measures, with an awareness of creative individual potential.
- To record and reflect on their changing perspectives and interpretation of current and seminal literature for their future in teaching.

To ascertain the effectiveness of our 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 pre-service programme. Findings also inform us of beginning teachers' levels of confidence in teaching Technology on exiting the Faculty of Education and after their first year of teaching.

Methods

Our research utilized a mixed methods approach, which Creswell, Plano Clark, Gutmann and Hanson, (2003) and Creswell (2005) 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 student teachers provides rich data about the perceived effectiveness of pre-service education and the student teachers' levels of confidence in teaching technology, while the qualitative data provides in-depth explanations for the patterns identified in the quantitative data.

Summary of 2008 graduating pre-service student questionnaire responses

The 2008 cohort produced a small response, with only 5 out of 17 graduating students returning completed questionnaires.

Most participants felt that they had developed a sound understanding of the core philosophy that underpins technology and the learning area of technology. Positive responses were made regarding their level of confidence in teaching the Technological Practice Strand. Participants were less familiar with the two new strands of The Nature of Technology and Technological Knowledge and the intent of their components of practice. The overall lack of confidence in understanding of the Technology learning area structure is understandable since the two newest strands

were still in stages of development and refinement in 2008. Similar considerations apply to understanding of the *Indicators of Progression*^v that were still under revision at this stage and have remained so to some extent until this year.

Of the 5 questionnaire respondents, 4 agreed to be interviewed. We summarise their perceptions of the pre-service course and their confidence and readiness to teach technology.

Summary of findings of the graduating 2008 pre-service student interviews.

At the end of their pre-service year, the four respondents were looking forward to their first year of teaching with positive anticipation tinged with some trepidation. All four students found the technology components of their courses helpful as they felt that they had picked up so many strategies to use in other subject classrooms, although they would have liked more time to put theoretical aspects of the course into practice. Gina felt that she learned more of the new New Zealand Curriculum through the Technology courses than other areas of her training. Daniel noted that the links made to industry were extremely relevant for him to see the parallels between his own career, technology education and classroom practice. Comments relating to possible improvements to our programme included mention of the lack of contemporary computer equipment that is commonplace in industry.

The four students interviewed graduated with a feeling of some confidence as they looked towards classroom teaching. They all felt that they understood the intent and implementation methods of the Technological Practice strand, but with less understanding of the relevance of the other two strands. Three felt that the wording of the Technological Knowledge and Nature of Technology strands is confusing and hard to interpret for classroom practice. They had however, developed an understanding of the Technology learning area as it stood, and had experienced the reality of school community acceptance and approach to the subject. They learned not only from the lecturers modelling effective practice that would translate into their own classroom practice, but also from discussions with their student colleagues. They spoke with respect of their cohort who came to teacher training from vastly different career backgrounds and the high calibre of the content and presentation of their assignment work. Daniel summarised the feeling of mutual support across the cohort when he said that the creative approach and level of understanding of his peers boded well for this potentially exciting learning area and that they all had become 'life long learners' keen to encourage the same of their future students.

Findings of 2008 cohort interviews at teaching registration stage of PRT^{vi}

Interviews of the 2008 cohort participants have been undertaken at the end of their two years teaching that brings to an end the designated PRT period of teacher training. Only two of the initial interviewees were available for this stage of data collection. Of the two teachers interviewed one has been teaching Art and is about to return to teaching Graphics^{vii} and Technology at a junior level at the time of this interview.

The second interview participant has taught the subject Graphics at a large co-educational state school in 2009, in her first year of teaching. Gina noted that the school focus was on the apprenticeship skill acquisition model regarding its students as more suited to trades than university. She has now gained a teaching position for this year (2010) teaching Graphics to senior levels and one junior Technology class at a private girls' school. She explained her approach to student-centred learning where she selects an issue such as a social cause that her students relate to, and together they develop a design brief to drive the practice and resolve the issue right

through to unique and individual outcomes. She noted that generic technology courses, except those in textiles, have little status in the school as the students are expected to enter training for medicine or law. She has found that if she plans an activity that she enjoys then that translates to student enjoyment and engagement.

2009 graduating pre-service student questionnaire responses and findings

The entire 2009 cohort of 29 graduating students returned completed questionnaires. We attribute the much-improved response to the deliberate factoring in of the questionnaire completion in the final days of our contact with the students before they left. However, of the 29 questionnaire respondents, only 4 were available to be interviewed. We summarise their perceptions of the pre-service course and their confidence and readiness to teach technology taken from both questionnaire and interview.

There is an undeniable increase in student confidence evident when comparing the 2008 and 2009 cohort questionnaire findings. The majority of students were confidently looking towards their new career of teacher in technology classrooms and specialist areas. They feel able to provide a positive learning environment to introduce authentic learning experiences that are based on the broader curriculum and learning area requirements, although a few students have found the wording of the Technology learning area documentation difficult to follow.

2009 graduating pre-service student interview responses

The four self-selected graduating interviewees ranged from background careers in Computer Engineering, Food and Fashion to Design/Performing Arts. They all felt that they had sound understanding of the Technology curriculum statement and the philosophy that underpins the learning area. Most were feeling confident as they looked ahead to their first teaching placements. All however, voiced their feelings of uncertainty with aspects of learning area 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.

Findings of 2009 cohort interviews at teaching registration stage of PRT

We invited the entire 2009 cohort to attend an evening meeting to share findings of their first year of teaching. 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 the interviews prior to their first teaching year. One further participant was interviewed separately. Peter's first year of teaching in Technology has been to a predetermined course in an engineering workshop to meet Industry training standards, he is the only teacher in this area of specialisation. He anticipates that in the following year he will plan and teach 3 generic junior Technology option classes. He offered an overall observation that he and his student colleagues were trained to be technology teachers, but in reality they have all walked into very varied levels of acceptance of Technology. They have been required to quickly become familiar with whatever the school programme dictates having to 'tread their beaten track' in order to be worthy enough to win trust and in time, inform programme planning.

When asked to reflect back to whether their training year prepared them for teaching the group responses include:

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 fangled idea that the oldies can't relate to – we're going to push the oldies along anyway.

When asked if they left our training year with a positive feeling of confidence towards their teaching career, they all responded in the affirmative without exception. When asked if this feeling has endured, responses include;

My expectations are so different [from reality]. I thought that kids could do so much more, having been a technologist, familiar with processes I thought that kids would want to run with it, but they don't.

Overview of the 2009 cohort interview findings at teaching registration stage of PRT

Although the 2009 interview sample was smaller than ideal, the findings have informed our planning. We have acknowledged areas of concern that include the need for a more flexible outlook towards the reality of school acceptance and implementation of Technology. The second application of the graduating-teacher questionnaire has provided an encouraging account of the whole course with only some minor areas of concern (even in a climate of reduced hours) that the technology lecturing staff is working to address.

Concluding statement

It has been most encouraging to witness the development of the teacher persona and voice over the time span from graduand to registered teacher. We have noticed continued development and depth of understanding in our students' through their teaching roles, that is evident in their sophisticated and perceptive responses. Even in an uncertain climate of vastly differing school acceptance and implementation approaches to Technology, most of our students are able to adapt to what they have found. Many have had to endure being alone or overcome disappointment at the lethargy and lack of interest in learning in some school communities, although this seemed to be indicative of student, parent and school expectations across all subjects. They have felt the need to *tread water*, until proven worthy to contribute ideas to an existing, even seriously outdated programme. Although, overall we see them finding initial strength from their feed-in community of practice, they have all maintained a personal construct of the Learning area of Technology philosophy and broad intent to engage and empower their pupils. All have however, needed to walk the way of their school's interpretation of Technology; often disappointed that the learning wasn't fun. Very few were able to contribute to junior class programme planning towards a holistic, student-centred approach.

Students who hail from the broad range of Design practice instinctively know the way of creative-problem solving in learning. However, unless these successful graduands are able to mention a skill-base that they are familiar with when applying for teaching positions, only the very few progressive schools will employ them.

Implications to inform our practice

Our observations relating to our programme confirm that it is essential to affirm and value students own prior learning, career experience, skills and understandings to bench mark further learning. We aim to build a community that is supportive, open to discussion and flexible in its approach to the unfamiliar. We will continue to guide our students by modelling best classroom practice in workshop and design environments that encourage a creative approach to problem solving. We strive to keep abreast of

curriculum change by taking active part in National discussion and assessment. We intend to include opportunities through peer and individual assessment of assignment work to model and give feedback on assessment practice. We look to best classroom practice evidence on encouraging pupil reflection-in-action annotation to further inform our programme. We will continue to arrange meetings with past students to maintain the support network and unofficial dialogue after time as classrooms teachers in the hope that the light of enthusiasm and passion lasts well into their teaching careers.

Our hope is that in time a nationwide balanced interpretation of potentially the most important subject in the curriculum that sets all other learning in context will endure.

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ⁱ 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.

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

ⁱⁱⁱ Technological literacy - 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.”

^{iv} 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 influencing who people are and how they behave. It involves a person's active analysis of past

situations, events, and products...that can lead to change in thought or behaviour
Danielewicz (2001, pp. 155-156).

- ^v *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.
- ^{vi} Provisionally Registered Teacher (PRT) – the term given to teachers in training until the end of their second year of employment when they gain teacher registration.
- ^{vii} The subject *Graphics* was introduced to New Zealand senior schooling to better reflect the design and visualization communities of practice it built on the early precision *technical drawing* subject and instils an understanding of design and the application of design processing through design briefs. Graphics now comes under the umbrella of *Technology* in the NZC (2007) and has been renamed as *Design and Visual Communication*.