Am I ready to become a secondary teacher of technology? Trainee teachers' perception of their preservice technology education courses.

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Abstract
Changes in administrative structures in the merger of the Auckland College of Education and the University of Auckland, in 2004, and development of a new technology curriculum have significantly impacted on the kind of courses being offered at the pre-service level of secondary technology teacher education. A totally new set of courses was developed to meet the requirements of the new academic structures and cater for the evolving nature of technology education. As no previous research has been undertaken on the effectiveness of the programme in preparing student teachers to teach technology, the technology education lecturers were interested to find out how effective the new courses were. The object of this research was to investigate student perceptions of their knowledge of the 2007 curriculum, and their level of confidence, on exiting the Faculty of Education. Participants completed an anonymous questionnaire at the end of their University programme and a number of self-selected students were interviewed. These students will also be re-interviewed towards the end of the second year as provisionally registered teachers. This paper discusses the initial findings from the first set of data collection completed at the end of 2008.

Background
National understanding and acceptance of the New Zealand Curriculum's most recent learning area of Technology remains unresolved. The success of school programmes in technology can depend on whether the school, department or individual teacher has been able to keep up with the many and wide ranging changes brought about between the initial introduction of the first Technology Curriculum (Ministry of Education, 1995) and the learning area of Technology in the recently gazetted New Zealand Curriculum (Ministry of Education, 2007). A body of literature has documented the problems that teachers experienced in coming to terms with curriculum change in 1995, where students were "rarely provided with learning programmes that ensured coherent, ongoing development of their knowledge, skills and technological practice" Compton and Harwood, 2003). Jones and Moreland (2004) and Moreland, Jones and Northover (2001) support this observation. The climate of uncertainty presents challenges for

preservice educators in knowing how to prepare beginning teachers to teach technology confidently and effectively.

The Technology learning area aims to develop technologically literate citizens who are empowered and motivated to contribute to their community. Technological literacy is developed through rich and varied experiences across a range of communities of practice Keith (2007). Interestingly, pre-service programmes are increasingly attracting career changing specialist practitioners with a wide range of experience, including architecture, graphic, product and industrial design, electronics, building and construction, food and nutrition, fashion/textiles and accessory manufacturing and design and the digital technology areas. The wide variety of backgrounds of these applicants substantially enriches the body of technologically literate teachers but also presents certain challenges for course construction. An immediate challenge facing preservice educators is to facilitate the shift of perception in the specialist practitioner towards a more generalist technological literacy while acknowledging and building on their area of expertise. As Sanders (2001) notes, a major aim of the teacher education programme involves reducing the gap between vocational skills in guiding the experienced industry practitioner towards a confident and competent education practice. This is a tall order: to prepare a diverse group of people to deal appropriately and effectively with the philosophical, pedagogic and curriculum complexities of school technology environments. Gratch (1998) raises the importance of beginning teachers' pre-service and early practice experiences as a significant feature of their first year socialisation and enculturation into teaching (Huling-Austen, 1990; Kuzmic, 1994).

Often pre-service teachers have inappropriate constructs of the nature of technology and technology education that must be addressed (McRobbie, Ginns & Stein, 2000). These constructs have a marked influence on the way in which technology is planned for and taught (Davies, 2003). The broad ranging nature of technology poses problems with regard to the application of teacher content knowledge (Barlex & Rutland, 2003; Loucks-Horsley, 2000), and more particularly the specialised content knowledge of industry practitioners. Industry specialists don't lack confidence in their ability to teach technology but their inherent interpretation of the 'industrial tool use model', where a teaching focus 'exclusively about tools, machines, and processes (Hansen & Lovedahl, 2004), directs teaching towards a vocation rather than towards the development of technologically literate future citizens. Such an approach also affects teachers' ability to address cultural diversity within the classroom (McLeod-Brudenell, 1996). If indeed we do teach as we were taught (Hansen & Lovedahl, 2004), then many 'new technology teachers' will tend to organise and teach their courses using models similar to the programmes they followed in their pre-service training.

To deal with these issues our approach puts significant emphasis on achieving a balance of the mentor-protégé-facilitator (Odell, 1990) relationship and is intended to provide an emotionally supportive environment for developing pre-service teachers' confidence, beliefs, values and practices (Little, 1990).

The research questions focused on secondary provisionally registered teachers' beliefs about their readiness and capability to teach technology prior to

beginning teaching, and towards the end of their second year of teaching as PRT's (provisionally registered teacher).

Methods

A mixed methods approach was used to address the research questions, that is, to ascertain participants' perceived readiness to teach the learning area of technology. Mixed methods design can be desribed as a 'Sequential Explanatory Design' (Creswell, J. Plano Clark, V. Gutmann, M. & Hanson, W., 2003, p 223). An explanatory design 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, while the qualitative data provides in-depth explanations for the patterns identified in the quantitative data (Creswell, 2005).

The first stage (quantitative) surveyed pre-service students' levels of confidence for teaching technology. All end-of-year graduating pre-service students in the B.Ed (Tchg), GradDipTchg (Primary), and GradDipTchg (Secondary) programmes were asked to complete an anonymous questionnaire. There were two distinct cohorts in the B.EDTchg) group, those who had only done the compulsory course in the first semester of the three year programme (BE1) and those who has also completed an optional technology paper in the final semester of the three year programme (BE2).

An anonymous questionnaire was given to graduating student teachers to document their perceptions of their confidence and readiness to teach technology prior to graduation. The research was located after course completion in order to ascertain students' perceptions of the how well the course had prepared them for teaching. We have not, however, recorded initial perceptions of this cohort before entering the course. Further research will provide such data.

After initial data analysis of the first questionnaire, in 2008, 12 self-selected participants (5 secondary participants) were interviewed to explore issues and trends emerging from the data. The same participants will be interviewed towards the end of their second year as Provisionally Registered teachers. The process seeks to identify the level of effectiveness of pre-service and in-service technology programmes in preparing teachers to teach technology.

This paper reports and discusses the findings from the initial stage one questionnaire data collection.

The questionnaire had 4 sections (see Appendix). The first 12 questions related to student teachers' understanding of the 2007 technology curriculum. This was followed by 5 questions focussed on their preparedness to teach technology and 4 questions related to their confidence to plan and assess technology in schools. The final 3 questions were related specifically to the secondary school context and were only answered by students on the Graduate Diploma in Teaching (Secondary) programme. The responses were recorded on a 6-point Likert scale (very poor, poor, slightly good, good, very good, excellent).

The programme

The Graduate Diploma in Secondary Education (Technology) is delivered over two semesters. Semester one introduces the philosophical base that underpins the learning area of Technology in the New Zealand Curriculum through the foundation course EDCURSEC 639 'Introduction to Technology Education.' This course provides the basis for the programme and is a pre-requisite for all other courses within the secondary programme.

Table of courses:

Semester One	Semester Two
EDCURSEC 639 Introduction to technology education	EDCURSEC 640 Developing technological literacy
EDCURSEC 641 Teaching specialist technological practice	EDCURSEC 642 Implementing the technology curriculum
EDCURSEC 643 Educating for visual communication	EDCURSEC 644 Teaching graphics and design

Summary of the courses in technology;

EDCURSEC 639 Introduction to Technology Education
This foundation course for teaching technology education provides an opportunity to discuss the background philosophy that underpins technology education. It defines technology in society and analyses the pragmatics of the technology curriculum.

EDCURSEC 640 Developing Technological Literacy
Individuals are encouraged to view technology education through the lens of their own knowledge domain in order to see the relevance of their own skills and knowledge as inherent parts of the technology curriculum. This course also engages participants in the investigation of actual technological practice in the local community as a means of illustrating the interlinking nature of technological literacy.

EDCURSEC 641 Teaching Specialist Technology Practice
Participants engage in technological practice by carrying out an investigation of a technological problem similar to a classroom situation. By using specialist technological knowledge, a solution will be developed with consideration given to the nature of a school technology environment.

EDCURSEC 642 Implementing the Technology Curriculum
This course focuses on designing and creating teaching experiences for learners. It ensures that participants will engage in developing the documentation, resources and identifying project/theme/contextual ideas for developing junior and senior learning activities suitable for school classroom and meeting the needs of national assessment systems.

EDCURSEC 643 Educating for Visual Communication
This course develops understanding, competence and confidence in using visual communication methods to enhance learning. It focuses on the development of knowledge, understanding and attitudes associated with applying visual communication principles across the curriculum to support and enhance student-learning possibilities. A range of modes and media are explored and implications of these applications on student learning are investigated.

EDCURSEC 644 Teaching Graphics and Design
This is a foundation course for developing an understanding of graphics and design education. It provides an opportunity to discuss the background philosophy that underpins graphics education and discusses the advantages of using visual communication methods to inspire and enhance critical and creative thinking in problem solving situations. Participants analyse and define the key elements of design and see its relevance in personal and classroom project applications.

The findings

There was disappointing return of the questionnaires: only 5 out of 18 (28%) graduating students returned completed forms. This was due in some part to a delay in obtaining ethics approval and funding, which meant that over half the students were on study leave, occupied in completing their final assignments and/or applying for teaching positions. There was an attempt to send the questionnaires directly to the students but very few responded. However, of the 28% of students who did return questionnaires, all of them (100%) agreed to be interviewed.

Three (60%) felt they had a 'good' or 'very good' knowledge of the Technology Learning Area in the New Zealand Curriculum (Ministry of Education, 2007). Two (40%) rated themselves as having a 'poor' or 'slightly good' understanding. The returns for the Primary BEd course (57%), completed at the same time, showed a similar overall understanding. Note that the return rate for the Primary BEd cohort was higher, at 47% of the total graduands.

With regard to their understanding of the three strands within the Technology curriculum, the students rated themselves considerably higher for the Technological Practice strand. This was particularly evident in *brief development*, where all students (100%) indicated a 'very good' response, *planning for practice*, where 80% indicated 'very good' and above, and *outcome development and evaluation*, where 60% responded 'very good.' In the Nature of Technology strand, 80% indicated a 'poor' to 'good' understanding. Understanding of the Technological Knowledge strand was slightly more varied: 80% rating their understanding as 'good' or better for technological products, and rating of their understanding of technological modelling at 60% 'good' or higher and technological systems at 40% 'good' or higher.

Four (80%) of the students rated their course as 'good' or better in enabling them to form links between theory and practice, including two who gave an 'excellent' response. Over half (60%) gave 'good' or better response to the question asking how well they had been prepared to teach technology.

In response to questions on the students' degree of confidence in being able to provide environments to encourage authentic experiences and experiential learning, 100% responded with 'good' or better. However, the question relating to providing environments that encourage the development of tacit understandings in relation to technological practice was considerably lower, with 60% indicating only a 'slightly good' understanding. The question based on how well the students felt that the experiential (hands on) learning activities in the course had contributed to their understanding of technological practice produced an 80% 'poor' to ' slightly good' response.

Students rated their preparedness to develop programmes that promoted understanding of the interrelationship of technology and society much more positively (80% 'good' and above) and over half (60%) felt that their practicum experiences had prepared them to teach confidently in this area of learning.

The majority of students (80%) rated their ability to plan for authentic technological learning experiences and incorporate the characteristics of teaching and learning in technology in their planning as 'good' and above. However, responses to how they felt they were able to use the 'indicators of progression' for assessment purposes in a junior classroom were significantly less positive, with 60% indicating 'poor' to 'good.'

The response to how well they feel able to use NCEA Achievement Standards (60% 'good' and above) was more positive than how well they feel able to use Unit Standards (80% 'poor' to 'good').

Discussion

A factor that would have impacted on the survey results relating to student understanding of the learning area of Technology is that the group were training during the first year after the release of the 2007 curriculum. The significance of this situation is evident in the decision by the Ministry of Education to restrict the focus of technology education to a single strand, the *Technological Practice* strand. The lack of completed research on the final two strands prompted this action to ensure accurate national interpretation of the final two strands for implementation in 2009, at which time the revised curriculum was finalised. Because members of the Faculty of Education teaching team had been involved in the revision process, the students had been informed of the proposed changes to the 1995 Technology curriculum (Ministry of Education, 1995) and the development of the new structure of the Technology learning area in The New Zealand Curriculum (2007). The emphasis in courses taught at this time was centred on the Technological Practice strand and the transition between the 1995 and 2007 curriculum requirements. The 2008 questionnaire only asked students to rate their understanding of the 2007 Technology curriculum, which meant that there were aspects they may not have seen or investigated. Although this may have influenced the findings regarding understanding of the curriculum, it would not have influenced their ratings with regard to confidence to plan, teach and assess technology to the extent shown in the questionnaire responses. It is anticipated that when the 2009 intake are questioned, their levels of knowledge and confidence will be higher than the 2008 intake reported in this paper due to their interaction with all technology learning area strands. Lecturing staff have implemented current material to enhance and inform pre-service learning experiences, which should ensure a positive response from the 2009 participants.

Although the small number of responses by the GDS students (5) was too small to make any general statements, one very noticeable feature of the data is the range of responses among the five students, often ranging from poor to very good for the same question. These students had completed three technology papers over the year, and it was their major teaching subject, so it might have been expected that their responses

would range from ‘good’ to ‘excellent’, but two of the students clearly felt less well-prepared to teach than the other three.

Conclusion

Although the sample was smaller than ideal, the results of this first application of the graduating-teacher questionnaire has indicated some areas of concern that the technology staff are working to address. We anticipate that the results from the 2009 questionnaires and interviews will show some improvement on the responses of the 2008 intake, given that the focus for 2009 has been on the entire learning area of Technology in The New Zealand Curriculum (2007).

As we continue to analyse the transcripts of the 4 post-questionnaire interviews we expect to be able to more explicitly explore the factors underpinning the patterns within the responses to the questionnaire.

References

Barlex, D., & Rutland, M. (2003). Developing the teaching of food technology in primary schools in England through curriculum development and initial teacher education. *International Journal of Technology and Design Education, 13*(2), 171-192.

Creswell, J.W. (2005). Educational research: Planning, conducting and evaluating quantitative and qualitative research (2nd ed.). Upper Saddle River, N.J.: Merrill.

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

Compton, V., & Harwood, C. (2003). Enhancing technological practice: An assessment framework for technology education in New Zealand. *International Journal of Design and Technology Education, 13*(1), 1-26.

Davies, D. (2003). Pragmatism, pedagogy, and philosophy: A model of thought and action in primary technology and science teacher education. *International Journal of Technology and Design Education, 13*(3), 207-221.

Gratch, A. (1998). Beginning teacher and mentor relationship. *Journal of Teacher Education, 49*, 220-227.

Hansen, J. W., & Lovedahl, G. (2004). Developing technology teachers: Questioning the Industrial Tool Use Model. *Journal of Technology Education No. 2, 15, 20-32.*

Huling-Austin, L. (1990). Teacher induction programs and internship. In W.R. Houston (Ed.), *Handbook of research in teacher education.* 535-548. New York: Macmillian.

Jones, A., & Moreland, J. (2004). Enhancing practicing primary teachers' pedagogical content knowledge in technology. *International Journal of Technology and Design Education, 14*(2), 121-140.

Kuzmic, J. (1994). A beginning teacher's search for meaning: Teacher socialisation, organisational literacy and empowerment. *Teaching and Teacher Education, 10*(1), 15-27.

Little, J. W. (1990). The mentor phenomenon and the social organisation of teaching. In C. B. Cazden (Ed), *Review of research in education* (297-351). Washington, DC.

Loucks-Horsley, S. (2000). Advancing technology education: The role of professional development. *The Technology Teacher, 60*(6), 31-34.

MacLeod-Brudenell, I. (1996). *Teachers' confidence as a factor in addressing cultural diversity within design technology education for young children*. Paper presented at the IDATER.

McRobbie, C. J., Ginns, I. S., & Stein, S. J. (2000). Preservice Primary Teachers' Thinking About Technology and Technology Education. *International Journal of Technology and Design Education, 10*(1), 81-101.

Ministry of Education. (1995). *Technology in the New Zealand Curriculum.* Wellington: Learning Media.

Ministry of Education. (2006). *The New Zealand Curriculum*: *Draft for consultation 2006* Wellington: Learning Media.

Ministry of Education. (2007). *The New Zealand Curriculum*. Wellington: Learning Media.

Moreland, J., Jones, A., & Northover, A. (2001). Enhancing teachers' technological knowledge and assessment practices to enhance student learning in technology: A two-year classroom study. *Research in Science Education, 31*, 155-176.

Odell, S. J. (1990). *Mentor teacher programs*. Washington, DC: National Educational Association

Sanders, M.E. (2001). New paradigm or old wine? The status of technology education practice in the United States. *The Journal of Technology Education, 12(2), 35-55*

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Appendix

Effectiveness of pre-service and in-service programmes in technology Student Questionnaire questions.

Please circle the appropriate answer for the following questions. When you have completed the questionnaire would you please post it in the sealed box by the student pigeon holes in N Block, level 3.

Curriculum

How would you rate your knowledge of technology as learning area contained within the NZC 2007 ?

very poor poor slightly good good very good excellent.

How would you rate your understanding of the components of the Technological Practice Strand?

- How well do you understand what is meant by Brief Development?

very poor poor slightly good good very good excellent.

- How well do you understand what is meant by Planning for Practice?

very poor poor slightly good good very good excellent.

- How well do you understand what is meant by Outcome Development and Evaluation?

very poor poor slightly good good very good excellent.

How would you rate your understanding of the Nature of Technology Strand ?

- How well do you understand what is meant by characteristics of technology?

very poor poor slightly good good very good excellent.

- How well do you understand what is meant by characteristics of technological outcomes?

very poor poor slightly good good very good excellent.

How would you rate your understanding of the Technological Knowledge Strand?

- How well do you understand what is meant by technological products?

very poor poor slightly good good very good excellent.

- How well do you understand what is meant by technological modelling?

very poor poor slightly good good very good excellent.

- How well do you understand what is meant by technological systems?

very poor poor slightly good good very good excellent.

How well do you think the readings from your course contributed to your understanding of technology ?

very poor poor slightly good good very good excellent.

How well do you think the readings from your course contributed to your understanding of technology education ?

very poor poor slightly good good very good excellent.

How well do you think the online curriculum support material contained on Techlink has increased your understanding of Technology and Technology Education?

very poor poor slightly good good very good excellent.

Pedagogy

How effectively has this course enabled you form links between theory and teaching practice?

very poor poor slightly good good very good excellent.

How well do you think you've been prepared to teach technology?

very poor poor slightly good good very good excellent.

-How confident do you feel in your ability to provide environments which encourage authentic learning experiences for students?

very poor poor slightly good good very good excellent.

-How confident do you feel in your ability to provide environments which encourage the development of experiential (hands on) learning ?

very poor poor slightly good good very good excellent.

-How confident do you feel in your ability to provide environments which encourage the development of tacit understandings in relation to Technological Practice?

very poor poor slightly good good very good excellent.

-How confident do you feel in your ability to provide programmes which develop an understanding of the inter-relationship between Technology and Society?

very poor poor slightly good good very good excellent.

-How well do you feel your practicum experiences have prepared you to teach confidently in this learning area?

very poor poor slightly good good very good excellent.

-How well do you think this courses experiential (hands on) learning activities have contributed to your understanding of technological practice?

very poor poor slightly good good very good excellent.

Planning and Assessment

How well do you think this course has prepared you to plan for authentic technological learning experiences?

very poor poor slightly good good very good excellent.

How well do you feel your planning will incorporate the characteristics of teaching and learning in technology ?

very poor poor slightly good good very good excellent.

How well do you feel you will be able to use the 'indicators of progression' for assessment purposes?

very poor poor slightly good good very good excellent.

How well do you feel you have been exposed to a range of appropriate assessment strategies for technology?

very poor poor slightly good good very good excellent.

Secondary

How well do you feel you will be able to use the 'indicators of progression' for assessment purposes in junior secondary classes?

very poor poor slightly good good very good excellent.

How well do you feel you will be able to use the NCEA achievement standards?

very poor poor slightly good good very good excellent.

How well do you feel you will be able to use the NCEA unit standards?

very poor poor slightly good good very good excellent.

Thank you very much for completing the questionnaire.

Interview questions for pre-service teachers

Will you briefly describe the course(s) you have completed as part of your teacher education programme.

What parts of the course(s) did you enjoy? why?

Do you feel prepared for teaching technology eduction? Why? Why not?

What elements of the course helped you feel prepared?

In your opinion are there any parts of the course you would like to change? Why?

With regard to the questionnaire we now want to explore your understandings of some of the general themes that have emerged from our initial analysis of them.

Would you like to make any other comments?