Pre-service Teachers' Perceptions of Technology and Technology Education

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ABSTRACT
Technology teachers' perceptions and understanding of the nature of technology heavily influences their perceptions of technology education and consequently shapes their teaching practice. Understanding the nature of technology is also an important component of technology education and in 2007 the New Zealand technology curriculum introduced a new strand called the Nature of Technology. An important part of initial teacher education programmes is therefore to help student teachers develop their concepts and philosophies of technology and technology education. This paper reports findings from a survey of New Zealand student teachers' perceptions of technology and technology education before and after their involvement in a compulsory course in technology education. The findings reported here are some of the initial results from one institution but are part of a larger project aimed at brining together similar data from across the country to inform development of pre-service technology education programmes.

Keywords: Pre-service teacher education, perceptions, technology

INTRODUCTION

This paper reports on the first stages of a national project investigating student teachers' perceptions of technology and technology education. The initial survey reported here explores the views of a cohort of primary teacher education students at the start of their undergraduate degree programme. The rationale for the project is based on recognising firstly that technology teachers' perceptions and understanding of the nature of technology heavily influence their perceptions of technology education and consequently shape their teaching practice, and secondly, the importance of developing initial teacher education (ITE) programmes that can respond to the views of the students involved and contribute to their developing pedagogical content knowledge (PCK).

In order for teachers to teach technology effectively it is necessary for them to have a well-developed understanding of technology (de Vries, 2012; Forret et al, 2011). There is an expectation that pre-service teacher education will develop teachers' understanding to align more coherently with the way technology is represented in the national curriculum and that this will build on the perceptions, understandings, and experiences that students bring into the programme. While teacher education in New Zealand has included technology education in its programmes for nearly twenty years, there has been little research into the perceptions of technology and technology education that student teachers hold coming into the programmes, or when they leave.

BACKGROUND TO THE RESEARCH

For any subject, curriculum changes provide potential for misinterpretation and mixed messages regarding curriculum intent and implementation. This potential is even greater for a relatively new curriculum area such as technology that has evolved from a range of syllabi and teaching approaches (Harwood and Compton, 2007). The current NZ technology curriculum presents a much broader view of technology and technology education than at any time in the past; a view that challenges the existing perceptions of many teachers. It frames learning in technology holistically using technological practice, technological knowledge, and the nature of technology as the main structural elements. In their Ministry of Education research report on student learning in technology, Compton and Compton (2010) identified a number of misconceptions, alternative understandings and partial understandings about technology in primary school students. These need to be addressed and require a sound teacher understanding of technology concepts and of the philosophy of technology.

One way to reduce confusion about the aims, purposes and nature of technology and technology education is to develop a consistent approach to technology ITE. Within New Zealand a well-established technology ITE community has developed a coherent approach to ITE that provides consistency in philosophy while supporting diversity of practice.
The Pre-service Technology Teacher Education Resource (PTTER) framework (Forret et al, 2011) is aimed at supporting a coherence of understanding and purpose amongst teacher educators and student teachers across ITE institutions.

The PTTER framework for technology ITE has four elements:

1. Philosophy of Technology - establishing philosophical foundations of technology as a field of human endeavour;
2. Rationale for Technology Education - examining rationale for including technology education as part of a core education curriculum;
3. Technology education in the New Zealand Curriculum - understanding how the New Zealand curriculum mandates and structures technology education;
4. Teaching Technology - understanding how to plan, teach and assess technology in the New Zealand Curriculum.

While all four elements are important, the first two are seen as foundational in technology ITE and the development of student teachers' PCK.

Much has been written about the nature of PCK since Shulman first introduced the concept in 1987. Magnusson, Krajcik and Borko (1999) sought to clarify the concept by proposing that a teacher's PCK comprises their;

1. Orientation towards teaching (knowledge of and about their subject and beliefs about it, and how to teach it);
2. Knowledge of curriculum (what and when to teach);
3. Knowledge of assessment (why, what and how to assess);
4. Knowledge of students' understanding of the subject; and
5. Knowledge of instructional strategies.

As with the PTTER framework, knowledge and beliefs about the subject are seen as important factors in the development of sound PCK.

In New Zealand, teacher education faces increasing political pressure to focus on literacy and numeracy education. As a result, other learning areas within the curriculum, while valued, are being squeezed into smaller and smaller 'spaces' within teacher education programmes (Ell,

2011; O'Neill, 2012; Thrupp, 2013). Within this context of reducing available time for curriculum ITE, teacher educators are forced to decide what to leave out of their programmes and how best to spend the little time they do have. The PTTER framework represents a foundational core aimed at addressing the variety of perspectives about technology and technology education that students bring with them to ITE programmes (Burns, 1990), and providing the most long-term impact on their developing PCK in technology education.

THE RESEARCH

Following on from the development and use of the PTTER framework within the main ITE institutions in NZ, it was agreed that a survey of students' perceptions of technology and technology education when entering ITE programmes across NZ, and again on exit, would provide valuable insights into the impact of these programmes. The findings reported here are some of the initial results from one institution. The larger project will bring together similar data from across the country to inform the ongoing sustainable development of pre-service technology education programmes.

Participants, data gathering and processing

Participants were primary teacher trainees enrolled in a compulsory, initial technology education paper at the start of their three year undergraduate degree programme. Table 1 shows the age and gender of participants with approximately 90% of respondents being females between 17 and 24 years old.

Table 1: Age and gender of participants

	Before	**After**
Age	92.6% 17-24	88.9% 17-24
Gender	90.6% female	89.9% female

Students were asked to complete a questionnaire at the beginning of the paper before any teaching had taken place and again at the end of the paper. The same questionnaire was used for pre and post implementation except that the post-teaching questionnaire included a additional open questions focused on students' experiences within the paper. The questionnaires included demographic information, Likert scale items and open response questions. Quantitative data were entered into SPSS and a two-tailed t-test applied to determine whether differences between pre and post responses were statistically significant. Qualitative, open statements were coded and examined for response themes. The research adhered to the university's ethical guidelines. Students' responses were voluntary and based on informed consent.

RESULTS

Table 2 shows the quantitative results for three Likert scale questions and displays the number of respondents (N), mean value responses and the 2-tailed, t-test significance (Sig). Significance values of 0.05 are significant at the 95% level and values of 0.01 or below are significant at 99% level or higher.

Table 2: Before and after responses showing number of respondents (N), mean response values and 2-tailed, t-test significance values (Sig).

	Before		**After**		
Question	**N**	**Mean**	**N**	**Mean**	**Sig**
1 How important is Technology to NZ as a country? (1-5) 1 = Not at all important, 5 = Extremely important	96	3.98	99	4.17	0.865
2 What do you think the subject/learning area called technology is mostly about? (1-3) 1 = no focus– marginally about, 2 = some focus, 3 = heavy emphasis					

Learning about electronics and machines	97	2.40	98	2.39	0.830
Learning about new inventions	96	2.27	96	2.47	0.310
Learning how parts of machines and systems work	95	2.24	98	2.42	0.211
Woodwork, metalwork, sewing, cooking	96	2.33	99	2.31	0.056
Learning about technology over time, place and cultures	97	2.39	98	2.57	0.040
Learning what experts in the community do in their job	97	1.91	98	2.22	0.027
Computers	96	2.68	98	2.37	0.010
Problem solving	94	2.34	98	2.85	0.000
Creativity, design & showing others your ideas	97	2.62	99	2.89	0.000
Thinking about the impact of technology	96	2.47	98	2.72	0.000
Planning and making things	95	2.53	99	2.83	0.000
Learning about resources/materials	95	2.38	99	2.75	0.000
Learning about what it means to do technology	97	2.34	98	2.70	0.000
3 Please indicate the extent to which you agree or disagree with the following statements. (1-5) 1 = Strongly disagree, 5 = Strongly agree					
Science and technology are basically one and the same thing.	95	2.25	99	2.26	0.800
Humans often develop new technologies to improve upon previous technologies.	96	4.21	99	4.27	0.726
Most environmental problems can be solved using technology.	95	2.72	99	2.95	0.536
Design is a process that can be used to turn ideas into products.	95	4.23	99	4.49	0.475
Engineering and technology are basically one and the same thing.	95	2.52	98	2.47	0.239
Technology is a small factor in your everyday life.	95	2.00	99	2.05	0.143
The results of the use of technology can be good or bad.	95	3.91	98	4.12	0.010

Perceptions of technology

The first question focused on perceptions of technology High mean values in Question 1 (3.98/4.17) show that a large majority of students considered technology to be very important to NZ as a country. The mean response increased after the paper but not significantly. This question was accompanied by an open response question – *Why do you think this*?

In the before questionnaire, one student who selected 2 on the scale, commented,
"*Because it isn't a part of New Zealand's culture*."

Students who selected 3 (moderately important) had a range of reasons, for example:

"*Technology is extremely common in NZ. It can however have positive and negative effects which is why I chose moderately important."*
"*It is important for the advancement of the country, but I don't think it's the be all and end all. There's nothing wrong with reading a real book, or writing things other than printing. We need to not depend on it*."
"*Because it is a part of the world we live in therefore important. But it is not an important part of all peoples lives like love and humanity is, so therefore only moderately important*."

Students in the before questionnaire who thought technology was very important generally cited the need for NZ to be internationally competitive and the important role technology plays in our everyday lives, e.g.
"*So we can keep up with the rest of the worlds advances in technology and to help grow NZ business wise*."
"*Because it is a part of our daily lives, without technology a lot of people wouldn't be alive*."

In Question 3, students' responses did not change significantly from before to after the paper except in response to 'The results of the use of technology can be good or bad' where there was a significant (0.010) increase in agreement with this statement after the paper.

In the after paper questionnaire, students were also asked the question 'Has your view of technology changed since completing this questionnaire the first time?' and, 'If yes, in what ways have your views of technology changed?' 85 (86.7%) students replied 'Yes' to this question. The majority of responses referred to a broadening of perceptions away from just computers, electronics and modern devices. For example,

"*I thought tech was about computers and electronics, however, now I know tech is much broader, ad it changes everyday."*
"I used to think technology was just about electronics such as computers and cell phones but now I know it is much more. I now understand that technology involves solving problems, modelling, design and much more."
"That there is so much more involved. It is how things are made and work. It makes you see the world in a different way."

Perceptions of technology education

In Question 2, students were asked what they thought the subject of technology was mainly about. Responses to the statements in this question showed a large number of significant changes from before to after the paper.
Students' views of the extent to which each of the following is involved in technology education increased significantly:

- Problem solving;
- Creativity, design & showing others your ideas;
- Thinking about the impact of technology;
- Planning and making things;
- Learning about resources/materials;
- Learning about what it means to do technology.

Students' views as to the extent to which computers are a focus of technology education decreased significantly (0.010).

In the after paper questionnaire, students were asked the question 'Has your view of technology education changed since completing this questionnaire the first time?' and, 'If yes, in what ways have you views of technology education changed?'

74 (78.7%) students replied Yes to this question. Responses tended to echo their comments regarding how their views of technology had changed, e.g.
"*Its not just about modern computers and phones",*
"More than just making things"
"I know that it is much more than just cooking, woodwork, sewing etc,, stuff that you do in school, and has a broader context."

Some had expanded their view of what technology education involved,
"A technology education is about learning and teaching about the ideas and the processes involved in developing ideas and improving products"

Others came to realise that technology education had an important role in primary education,
"Didn't really understand why it was important in primary levels to learn about tech", "I didn't think it was a subject so heavily taught at Primary School, but it is and quite a large one".

DISCUSSION
Our students enter our ITE programmes with a variety of views of technology and technology education. Like those reported in other studies (e.g. Burns, 1990), many students begin their ITE with a relatively narrow view of technology as a mainly modern development associated with high-tech, electronic devices such as computers and cell phones and that technology education will also focus on these things. While aspects of this type of view did not change significantly e.g. at the end of the paper, students still felt that technology education involved Learning about electronics and machines, Learning about new inventions, and Learning how parts of machines and systems work, at the end of the paper, their views on computers as a focus of technology education had reduced significantly.

The most significant changes occurred in the broadening of students' views of technology education to more strongly consider other aspects - Problem solving; Creativity, design & showing others your ideas; Thinking about the impact of technology; Planning and making things; Learning about resources/materials; Learning about what it means to do technology - as important in technology education.

Although the questionnaire attempted to make clear distinctions between questions about technology and those about technology education, it is clear from students' responses, particularly their qualitative responses, that their perceptions of technology and technology education were strongly entwined and for the large majority of students, a change in their views of technology was also accompanied by a similar change in their views of technology education. While perhaps not surprising, this result reinforces our view that prioritising the development of a sound understanding of the nature of technology is fundamental to successful ITE.

This paper has reported some of the findings from an initial survey and suggests a positive impact on student views in line with many of the aims and intentions of our technology ITE programme. However while we feel the results are generally positive, further analysis will be needed to more fully examine the data and consider how these findings might inform our practice. We also intend to refine the questionnaire for future use and look forward to combining our findings with those from other NZ ITE institutions to provide a national picture of students' perceptions of technology and technology education.

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