A FUTURE-FOCUS FOR TEACHING AND LEARNING: TECHNOLOGY EDUCATION IN TWO NEW ZEALAND SECONDARY SCHOOLS

ELIZABETH REINSFIELD
Office of ITE and Undergraduate Studies
The University of Waikato

Abstract

Technology education has been a part of the New Zealand curriculum in many forms since its inception as a craft subject. With a global push towards technological innovation and an increased awareness of the impact of technology on society, it is reasonable to assume that technology education has an established role in student learning around the local and international social issues that intersect with technology. This article is based on the initial findings of doctoral research, which aims to illustrate how teacher's perceptions and previous experiences influence their understandings around the nature of technology education in their school.

Keywords

Technology education; perceptions; secondary schools; understandings

Introduction

Teacher perceptions about the purpose of their subject area are heavily defined by their beliefs and values, which in turn, impact on their curriculum understanding as well as their professional practice (Pajares, 1992; Savaya & Gardner, 2012). Whilst attending a recent 'meet the teacher' evening, one of the technology staff described what would happen in class for the term. In this food technology class the students were required to cook twice a week (at home) to support the classroom learning, which would focus predominately on hygiene and practical skills. Such a description was pertinent to my PhD research, which asks how technology teachers' perceptions of the subject influence their enactment of the New Zealand curriculum.

The research

The study reported here utilised an interpretive paradigm, with a view to recognise the researcher's knowledge in the field of technology education. It used qualitative case study methods to describe teacher's understandings and practice because this provided the opportunity to describe "unique examples of real people in real situations" (Cohen, Manion, & Morrison, 2011, p. 289). By focusing on two schools and six participants, comparisons and differences in the nature of technology education can be transferred to a reader's own context but not generalised.

The research data was collected in five stages to allow for the triangulation of data and the convergence of conclusions (Miles, Huberman, & Saldaña, 2014). First, semi-structured interviews provided a baseline of data to communicate teachers' understanding of the curriculum resulting from their previous professional experiences. Second, the teachers were observed teaching a lesson. From there, the researcher attended department meetings over an agreed period of time to observe how each teacher interacted and communicated their understandings in a collaborative, professional environment. At the end of the data collection period, teachers were asked to reflect upon any changes in thinking that had occurred and provide resources that they had developed during this time. To ensure reliability across contexts, the same interview questions were used and the same protocols were adopted during each stage of data collection.

Corresponding author
Email address: reinsl@waikato.ac.nz (Elizabeth Reinsfield)
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Semi-structured interviews were selected as a data collection approach to encourage the formation of a trusting and reciprocal relationship with the participant (Luttrell, 2010) and to enable the sharing of personal experiences. Each semi-structured interview lasted approximately forty minutes, was recorded and transcribed to allow for the verification and validation of the record (Cresswell, 2012; Kvale, 1996). The interview consisted of several key questions, which were shared with the participants before the meeting.

The baseline interview data was transcribed and then imported into Nvivo. Nvivo software is suitable for qualitative data analysis because of its ability to process large sections of written text. From the interview transcripts, themes were identified and linked to the research questions with a view to extrapolate implicit and explicit ideas within the data (Guest, MacQueen, & Namey, 2012).

The participants

Whilst the schools were purposefully selected, the participants were volunteers and had expressed an interest in developing their understanding and practices within their own school context. Three of the participants had a local reputation for innovative practice in the field of technology education and the other three were teachers from overseas with varying experience. The participants taught a range of technological areas including digital, food technology, and product design. Table 1 provides an outline of their experiences.

Table 1: An overview of participants' experiences, qualifications and specialist roles

Teacher	Years in the teaching profession	Qualifications, roles and experience in Technology Education
A	16 years in Australia. 1st year in New Zealand.	History teacher; Cabinet making certificate. First year of teaching technology education in New Zealand (Hard materials).
B	Over 25 years in New Zealand	Taught school certificate woodwork, then workshop technology, Design technology and technology (Hard materials). Head of faculty in School A.
C	Over 20 years of experience in South Africa. Over 5 years in New Zealand.	Food buyer at an Institute of Technology, then a tutor technician, then a lecturer. Over five years in one New Zealand school teaching junior food technology and science.
D	Several years at unqualified teacher status in England. Over 6 years in two New Zealand schools.	Coding and programming teacher in England. Information communication technology teacher.
E	Over six years in three New Zealand schools.	Chef for several years. Has taught technology education in one high school, one intermediate. Specialist leader of food technology at junior high school.
F	Over 25 years in New Zealand.	Long tenure in one secondary school, teaching graphics and hard materials. Specialist leader of product design at the junior high school.

Background

Technology education has seen significant conceptual change since its inception. Some teachers of the subject appear to have experienced some difficulties during this transition and consequently, the subject can sometimes be seen as a means to develop student's practical or vocational skills instead of being an avenue through which current global and technological issues can be investigated and responded to. The study upon which this article is based, adopts the view that technology education allows unique and innovative opportunities for teachers to develop student's understanding of current

technological issues that pertain to society both nationally and internationally. According to the literature, teacher efforts to enact such practices are sometimes hindered, for a multitude of historical or organisational reasons (Forret, Jones, & Moreland, 2000; Jones, Buntting, & de Vries, 2013; Jones & Compton, 2009; Reinsfield, 2012, 2014; Williams, 2009). The research presented here aims to investigate how technology teachers' perceptions influence their enactment of the New Zealand curriculum.

The New Zealand curriculum

In 2007, the revised and 'future focused' New Zealand curriculum (Ministry of Education, 2007) directed that education should reflect the "changing diversity of society, within a context of global, social and technological change" (p. 4). There were several new directions in this official document, but pertinent to this research was the shift to principles that "put students at the centre of teaching and learning" (p. 9). According to Brough (2008), a student-centred curriculum can be aligned with Dewey (1997), who theorised that education should be focused on a student, within their community. Dewey argued that such an approach was more likely to provide opportunity for the engagement in meaningful and authentic learning. From Dewey's perspective schools should be democratic environments where learners work together to solve real-life issues. Such a philosophy is of interest here because it suggests that for students to gain the most from their learning, educational outcomes should be negotiated with them.

Curriculum policy in New Zealand means that it is legitimate for teachers to be empowered as decision makers (Beane, 2005), to interpret the policy document and make the learning appropriate for their school context.

In technology education however, there are a diverse range of perceptions around the nature and purpose of the subject because technology has evolved from a subject that has technical and vocational beginnings to be more academic in nature (Biggs, 2006; McLintoch, 1966). The subject is presented here as a means with which students can engage in tasks that focus on informed, creative and critical problem solving rather than as solely a pathway towards the trades (Reinsfield, 2014). It provides an opportunity for teachers to expose students to learning around current global and social issues. Whether they do so is likely to be determined by the way they perceive the subject's role in education.

Technology education can be taught through a variety of different areas, including structures, control, food, information and communications technology or biotechnology. The subject is defined in the New Zealand curriculum statement as

> … intervention by design, the use of practical and intellectual resources to develop products and systems … that expand human possibilities by addressing needs and realizing opportunities. Adaptation and innovation are at the heart of technological practice. Quality outcomes result from thinking and practices that are informed, critical, and creative. (Ministry of Education, 2007, p. 32)

The intention of a curriculum statement is to communicate how the subject is conceptualised. Whilst practical, quality outcomes are mentioned, the cognitive and social learning that occur during the process of technological practice are also emphasised.

Technology education in the New Zealand curriculum (Ministry of Education, 2007) has three strands; technological practice; technological knowledge and the nature of technology. Technological practice consists of the content from the previous curriculum document (Ministry of Education, 1995) and is about the making of products. Technological knowledge focuses on the processes and properties that inform the development of a product and the nature of technology strand encourages the teacher to facilitate learning where students can "critique the impact of technology on societies and the environment and to explore how developments and outcomes are valued by different people in different times" (Ministry of Education, 2007, p. 32).

So, does a child cooking at home or learning about hygiene in class therefore address the intent of the official technology curriculum? It's not as simple as yes or no. The three strands in the junior secondary context can be delivered over a two-year period and within a multitude of technological

areas, so perhaps some parts of the technology curriculum are better delivered elsewhere in the technology department or at another time. Equally, some content delivered within a programme is likely to be historically placed (something that has always been done) or valued by a particular teacher and considered pertinent to the scaffolding of skills within that specific technological area (such as learning how to do the washing up).

The aim for technology education however, according to the New Zealand curriculum (Ministry of Education, 2007), is for "students to develop a broad technological literacy that will equip them to participate in a society as informed citizens and give them access to technology related careers" (p. 32). Technological literacy was defined by Rose (2007) as something that "embodied the knowledge and skills needed to function in a society dominated by technological innovation" (p.35). The 'knowledge' consists of an appreciation of how technology, society and the environment may intersect (Williams, 2009). In a school context this would mean that technology teachers are likely to draw upon a range of contexts or disciplines to provide learning opportunities for their students.

Teacher perceptions

A teacher's view and consequent interpretation of the official curriculum and his/her pedagogical beliefs are driven by personally held values and beliefs about the role of education and the purpose of the subject they teach (Alsup, 2006). Pajares (1992) asserted that beliefs could be defined as

> … attitudes, values, judgments, axioms, opinions, ideology, perceptions, conceptions, conceptual systems, preconceptions, dispositions, implicit theories, explicit theories, personal theories, internal mental processes, action strategies, rules of practice, practical principles, perspectives, repertories of understanding, and social strategy. (p. 309)

The challenge in this research is in determining where and how a teacher's personal beliefs influence the knowledge that they perceive to be important to the teaching of technology education. Roehler, Duffy, Herrmann, Conley, and Johnson (1988) argued that knowledge should take precedence over belief because it is a fluid concept, which evolves as new experiences and are interpreted and integrated into teaching practice. This assumes however, that teachers are empowered to reflect upon and apply new knowledge to their evolving practices. Some teachers have found the implementation of the current curriculum difficult because of the need for them to re-consider their beliefs around the purpose of the subject (Reinsfield, 2014). The need for change is received in differing ways but for some their response is to sustain or retreat to historically placed practices (Paechter, 1995). Schiro's (2008) four ideologies are helpful to explain a teacher's practice because they assert that technology teachers are likely to align with four main perspectives: scholar academic; social efficiency; learner centred and social constructionist. These ideologies have been adapted to apply to the author's research focus and are defined below.

1. Scholar academic (Knowledge driven): A technology teacher may be situated in a school where scholarships and student academic outcomes are prioritised.
2. Social efficiency (Socially driven): This technology teacher aligns with the view that the purpose of the subject is to train students to be functioning members of society, either through vocational or technology education. There is likely to be an emphasis on skills development.
3. Learner centred (Student driven): A technology teacher focuses on the needs of the individual, directing the learning towards a student's growth of their intellectual, social, emotional and physical attributes. To enable this, teachers are likely to negotiate some of the learning outcomes with their students.
4. Social re-constructionist. (Philosophically driven): This technology teacher views the purpose of education as a means with which to facilitate the construction of a more just or equal society. Student learning considers the 'bigger picture' both locally and internationally.

It is acknowledged here that a technology teacher is likely to align with more than one ideology because of the tensions surrounding their pedagogical enactment in a particular school context. (Reinsfield & Williams, 2015). The culture within a school or community is also likely to have direct implications for a technology teacher's ideologies, understanding and interpretation of the curriculum.

Findings and discussion

The findings presented report on two schools contexts and six participants. Discussion is based on the content and frequency of participant's comments and their alignment with the differing ideologies. There is some suggestion of what this might mean for future-focused thinking in technology education classrooms in New Zealand.

The research contexts

Teachers A to D were in school A and teachers E and F, in school B. Both schools were purposefully selected because they were experiencing a period of change and because of their potential for theoretical sampling. Theoretical sampling is used when participants are positioned to generate new knowledge or theory (Cohen, Manion, & Morrison, 2011). The first school was of interest because it was known within the technology education community that there was a newly appointed head of faculty who had a nationally established reputation for his contributions to the subject over many years. Four teachers in this school, including the head of faculty, agreed to be participants in the research.

The second school was a newly established secondary school. The collection of data occurred during the first term when teachers were working together to develop their understanding of the curriculum, which was taught in an integrated manner. This proved to be a unique opportunity to view pedagogical decision making from a different perspective and to observe how teachers might be enabled to think creatively and without historical or school community constraints.

Initial impressions

The initial impressions regarding teacher ideologies presented an interesting picture. Teacher A appeared to be predominately philosophically driven. Two teachers acknowledged the influence of the school's academic expectations on their practice but were predominately socially-driven (Teachers B and D), along with teacher C. Teachers E and F emphasised the view that their current pedagogical approaches aligned with student-driven ideologies. It may be significant that the two teachers who talked about student achievement outcomes were based in school A, which had a reputation for a more traditional model of education. The two participants in school B both emphasised the need to encourage student voice and empowerment suggesting that they felt more autonomy to enact the curriculum as presented in the official curriculum document.

The learning

When teachers were asked to describe the teaching and learning that occurred in their classroom, all made reference to the need for students to understand what they were learning. Teachers A, D, E and F talked about how they aimed to make the learning meaningful and 'authentic' for their students. For example, Teacher E stated "we talk about the power of technology for good… how technology is inert and it's actually our human values that make it good or bad".

Five of the six teachers explained that they encouraged student voice, to enable learner empowerment and facilitate discussions around the relationship between technology and society. Teacher F explained that students' understandings around societal issues in food technology could be developed through….

> Examples that talk about the role that society plays in moulding former outcomes, the effect on health and safety, ethic[al issues] like gluten free or vegetarianism … Sometimes packaging can be deceitful, that kind of thing.
>
> [Activities] like student feedback and learning from other's throughout the process is very important. I like to do heaps of group work to gain understanding because four heads are better than one and just lots of research, lots of reflecting and lots of hand-on activities because that's what students like to do to make sense of things.

The teaching

The pedagogical approaches described were varied but all teachers explained that technology education provided an opportunity to allow students to test products, develop prototypes, experiment and be self-directed. All teachers identified that there was a need for students to develop skills and understanding with a range of materials to support their evolving knowledge. Teacher C explained that skill development was helpful to the development of quality outcomes when she:

> came around to doing a sauce … thank goodness I did the Sauce Unit, where they do the [pasta with] sauce for a teenager after school, something they can just heat up and pour over their pasta. They made sauces the other day, and they added cheese, and they probably remembered that you don't cook the sauce with the cheese in, because they'd done it before.

It was not unexpected to see the manufacturing process being identified in the practice of all teachers. Teacher F explained that this was because:

> the practice strand is the most desirable and the one that the kids love to do and so you [can] default to that. I feel that it's key to developing a good quality outcome so you need to have the nature strand there for students to understand, you know, past and future trends.

Teacher F is intimating here, that the practical component of technology education is a means with which to engage students.

Teachers B and C did not explicitly identify the need to contextualise learning to make it more meaningful for learners. Both of these teachers talked about how the subject is required to meet the student's learning needs, as well as their communities' expectations. For example, teacher B stated:

> [Technology education] doesn't suit every student, but neither does maths and english, okay? … we've got alternatives. We run our vocational pathway. But in general, I think it caters for 90% of the students, especially up to Level One, the [n the] academic side of it starts to grow a little bit. The good thing about [technology education] is you can tailor it to fit your school … I think people are starting to realise that now.

Emerging themes

Illustrated in the figures following are the themes that emerged after analysis of the baseline interview data, which has been presented for each of the proposed ideological stances. The frequency of teachers' responses are indicated in brackets.

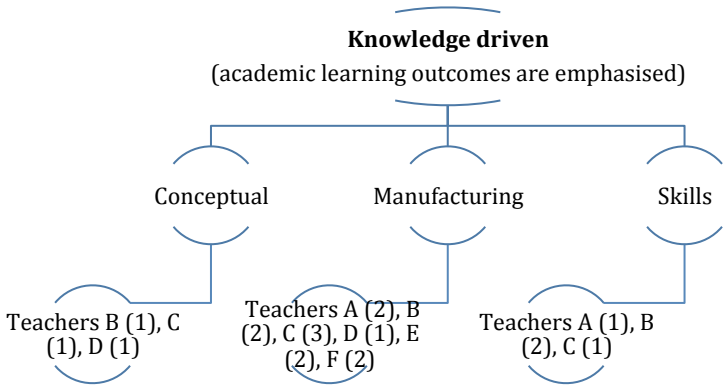

Figure 1: A visual representation of the emerging themes that result from a knowledge-driven ideology

Some themes are identified in more than one ideology because they address teaching and learning from a different perspective. For example, within a knowledge-driven ideology, a teacher's intention

when developing skills is likely to be for the purpose of raising student's academic outcomes (Figure 1) but if a teacher aligns with a student-driven approach, they are more likely to provide authentic learning opportunities where evolving knowledge can be applied in alternative contexts and for different purposes (see Figure 2).

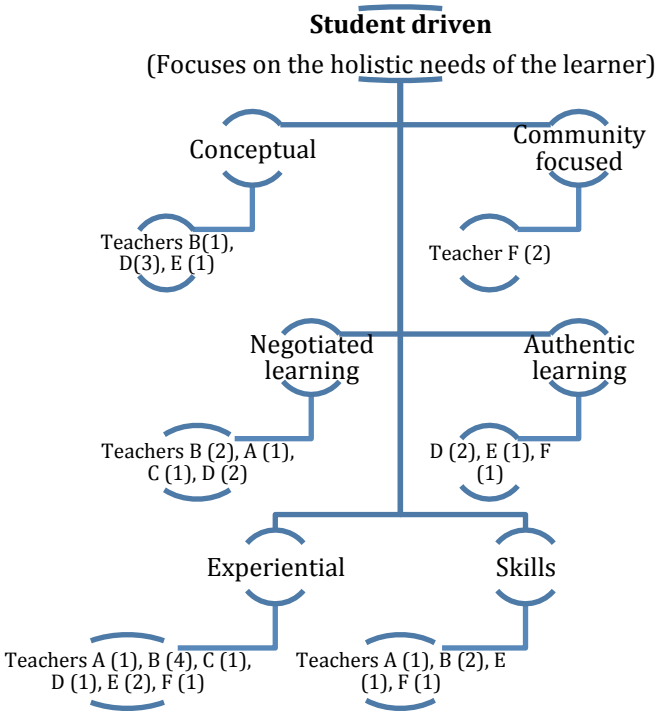

Figure 2: A visual representation of the emerging themes that result from a student driven ideology

The difference here is that a knowledge driven approach focuses solely on knowledge for the successful achievement of a task through step-by-step instruction whereas the latter focuses on the development of thinking skills. Each have differing underpinning beliefs about the purpose of technology education, the first being more closely aligned with vocational education and the latter representing the future focused approach within the current technology education curriculum in New Zealand.

Interestingly, parallels can also be made between the socially driven and philosophically driven ideologies. Teachers who talked about authentic learning opportunities in Figure 3, were talking about the connections that they were making to their own professional experiences (as a wood-worker, programmer and chef for example) rather than considering wider societal issues that might affect learners in the future (Figure 4).

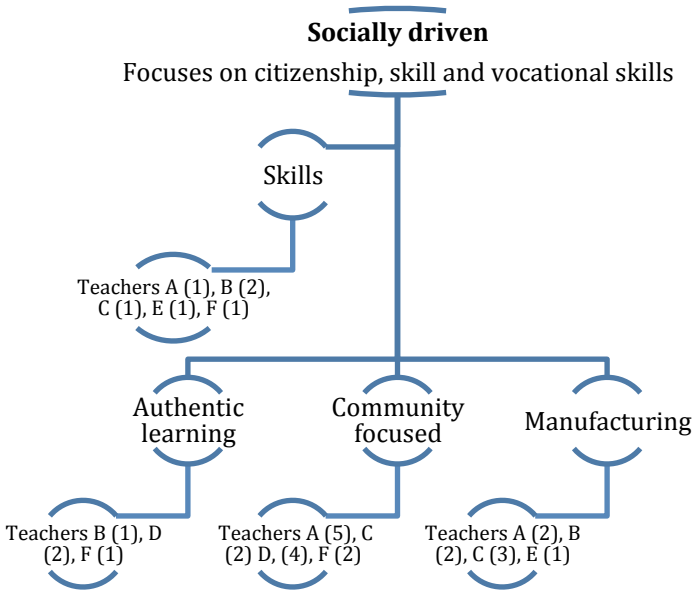

Figure 3: A visual representation of the emerging themes that result from a socially driven ideology

Teachers A, E and F were the only teachers who made mention of the wider issues between technology and society. Teacher's E and F made clear connections between the nature of technology strand of the curriculum and the way that it enhanced students' understandings around technological thinking.

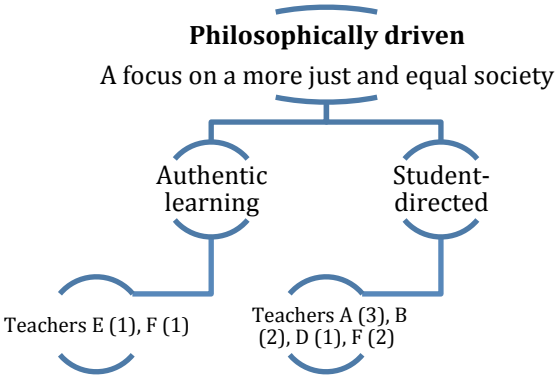

Figure 4: A visual representation of the emerging themes that result from a philosophically driven ideology

Five of the six teachers acknowledged that technology education allowed students to develop skills that would help them be a functioning member of society in the future, whether that was through the development of essential thinking skills or through vocational pathways. None of the teachers made the overt connection to any global societal issues that would enhance learning in technology education.

Once the initial impressions from the baseline interviews were aligned with the frequency of responses and the differing ideologies, a fuller picture emerged. Teacher A, D, E and F presented a comprehensive understanding of the purpose of technology education as represented in the official curriculum, but they also acknowledged that the constraints within a school environment could impact on their teaching approach. Teacher B, whilst acknowledging his background in the trades appeared to align with a student driven ideology, although his teaching adopted a more traditional approach, to

respond to his school's expectations. Teacher C was knowledge and socially driven, perhaps as the result of her past teaching experiences and current role in the junior school, where she was required to prepare students for a vocational pathway in the senior secondary school.

Conclusion

It appears that teacher perceptions about the purpose of their subject, understanding and enactment of the curriculum are indeed heavily influenced by their beliefs and values. Teacher ideologies in technology education are a sound starting point to understand what drives the way that teachers make sense of the curriculum. It is clear however, that a teacher's ideological perspective may have to be adapted, to suit the expectations in a school community. There is a suggestion that these teachers' understanding of the curriculum is well established and that practice in some classrooms is future-focused. However, parental expectation, departmental hierarchy and vocational pathways continue to hinder some teachers' practice.

It appears that teaching, which aims to develop students' understanding of the "changing diversity of society, within a context of global, social and technological change" (MoE, 2007, p.4) is likely to be more easily realised in schools where teachers are encouraged to be legitimate decision makers in their classroom. These technology teachers are finding meaningful ways for their students to learn about the subject and some are leading thinking around how current technological issues can be responded to at a local level. In order to consolidate this practice and then consider wider global issues, some teachers will need to find ways to negotiate the challenges that they face, in their schools.

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