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- book reviews.

Publisher: The Technology, Environmental, Mathematics and Science (TEMS) Education Research Centre, which is part of the Faculty of Education, The University of Waikato, publishes the journal.

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Cover Design: Roger Joyce

This journal provides immediate open access to its content on the principle that making research freely available to the public supports a greater global exchange of knowledge.
ISSN: 2382-2007

australasian journal of
TECHNOLOGY EDUCATION

The uncertainty of a future-focused curriculum in New Zealand: The perceptions and practice of six secondary school technology teachers

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Abstract

New Zealand education has had a technology curriculum since the mid-1990s. In response to the way that technology is evolving and to emphasise a future-focus, the curriculum has been recently revised. For some teachers, the diversity of perceptions characterising the nature of the subject appears challenging and influences their interpretation and enactment of the curriculum. This article reports findings from interpretive, socio-cultural research, which sought to explore teachers' understanding of technology education in two New Zealand secondary schools. There is a focus on the data collected using interview and observation methods. The findings highlighted that some technology teachers' practice is limited by the knowledge that they find troublesome, indicating that, to enable the enactment of a future-focused curriculum, it is timely for practitioners to reflect upon their current understanding. Recommendations are made to support teachers' evolving practice in the New Zealand context.

Key words: Future-focused curriculum; Liminality; Responsive pedagogies; Perceptions; Secondary schools; Technology education; Troublesome knowledge.

Introduction

Technology education in New Zealand has experienced significant conceptual change within its curriculum and is heavily influenced by governmental agenda, community expectations and teachers' differing perceptions of the purpose of the subject (de Vries & Mottier, 2006; Jones, 2009; Reinsfield, 2014). A recent governmental emphasis on a future-focused curriculum, advocates for practices, which are learner-centred in nature, and designed to emphasize critical and creative thinking, in a variety of ways (Organisation for Economic Co-operation and Development (OECD), 2017). How technology teachers' embrace a change in their practice, however, is likely to be the result of their perceived purpose of the subject.

The role and status of technology education has evolved, but its cross-disciplinary nature means that there is no single theoretical perspective that can define it (Pacey, 1992). This uncertainty presents a confusing climate for some technology teachers but also provides a research context to explore how practitioners navigate the challenges faced in their professional practice. Interest in a perceived disparity between teachers' curriculum theory and practice in technology education led to the overarching question of the research, which was:

> How do technology teachers' *perceptions* influence their *interpretation* and *enactment* of Technology in the New Zealand curriculum (MoE, 2007)?

Research context

The National Education Guidelines (Ministry of Education (MoE), 2004) in New Zealand encourage schools and teachers to interpret the official curriculum and make decisions about the appropriateness of learning in their school context. The aim of technology education, according

to the *New Zealand Curriculum* (MoE, 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). Technology education can be delivered as a distinct learning area or within an integrated curriculum. As a result of practical or conceptual means, teaching can be contextualized to address the learning needs of a particular group of students. The components within each strand of the New Zealand technology curriculum are outlined below.

Table 1. The eight technological components

Technological Practice	Technological Knowledge	Nature of Technology
Planning for Practice	Technological Modelling	Characteristics of Technology
Brief Development	Technological Products	Characteristics of Technological Outcomes
Outcome Development & Evaluation	Technological Systems	

Source: *New Zealand Curriculum* (MoE, 2007).

A teacher's engagement with a curriculum encompasses personally held values and beliefs about the role of education and the purpose of the subject they teach (Alsup, 2006). In the New Zealand context, it is the teacher's professional responsibility to reflect upon how their teaching facilitates "thinking and practices that are informed, critical and creative" (MoE, 2007, p. 32). Some teachers have found this process difficult, however, because of the need to align their attitudes with both the technical and technological conceptions of the subject. A technical conception can draw upon a pedagogical style that is traditional in nature, with an emphasis on the replication of existing products. Alternatively, a technological way of thinking maintains the creative and practical nature of the subject, but also emphasises problem-based and critical thinking, to encourage students to address identified societal issues (Reinsfield & Williams, 2017).

To fulfil their professional responsibilities, teachers in New Zealand are expected to continue to develop their pedagogical understanding and maintain currency within their educational context (New Zealand Education Council (NZEC), 2017). Despite the importance of developing teachers' understanding, professional development opportunities in technology education can be fragmented, detached from the curriculum and counter to teachers' learning needs (Borko, 2004; McDiarmid & Corcoran, 2000). There is a tension being manifested between the accountability of teachers and the requirement for them to participate in pedagogical risk-taking which supports students' understanding, and to enable their contribution to society in the future.

Such a climate requires teachers to be adaptive practitioners who have the motivation and capacity to be responsive to their students' needs. Adaptive teachers are able to manage the complexities that influence their practice (Soslau, 2012); they are reflective and choose pedagogies in a deliberate and informed way, to improve their students' future learning outcomes (Lampert, 2010). This is pertinent in technology education because the potential to engage students in learning that considers contemporary societal issues does not appear to be consistently realized. The next section contextualises secondary technology education in New Zealand and outlines how teachers' perceptions might influence their practice.

Technology education

Technology education can expose students to knowledge that is fostered as the result of working with a range of materials and systems, through the development of a concept or outcome, and in response to an identified problem (Ferguson, 1993; Hill, 2003; Reinsfield & Williams, 2017). In 1995, *The New Zealand Curriculum* (MoE, 1995) aimed to establish technology education as a core subject rather than a means of occupational training. Ferguson (2010) stated that advocates for this new approach proposed, "from the outset, technology [had been] seen as something

distinct from technical education, [e.g. workshop, craft and home economics]" (p.6). Despite community recognition that some teachers had found the change in curriculum difficult to navigate, the 2007 technology curriculum (MoE, 2007) consolidated an epistemological shift, which had begun in 1995. Technology education became a subject that recognized the theoretical and conceptual dimensions in the differing domains of structure, control, food, information and communications technology, and biotechnology (MoE, 2007, p. 32). The 2007 curriculum more explicitly acknowledged that technological development could be heavily influenced by society and culture, either historically, in the present, or in the future context. This was a positive move because it presented opportunities for learning to be future-focused in nature.

The current government mandate in New Zealand is that all schools will have learner-centred pathways, champion twenty-first century pedagogies and provide quality, responsive, and future-focused teaching (MoE, 2016). Research findings suggest that this presents an opportunity for innovative practice by secondary technology teachers, who aim to enact the subject in a manner that reflects the rapid rate of technological change in society.

Teacher perceptions

Research into teachers' perceptions has generally focused on values, beliefs and the effect of lived experience on practice (Bell, 2010; Chikasanda, Otrel-Cass, & Jones, 2011). Some literature considered practitioner understanding of the concepts presented within a curriculum (Bungum, 2006; Cowie, Moreland, Jones, & Otrel-Cass, 2008; Jones & Compton, 1998) and on emerging practices in the classroom (Jones & Moreland, 2003; Mittell & Penny, 1997; Jones, Moreland, & Northover, 2001). Other research explored how teacher perceptions influenced the effectiveness of professional learning and as a means to enable pedagogical change (Aminudin, 2012; Johnson, 2011). Jones (1997) used Pajares' (1992) conception of perceptions, 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. 4)

Perceptions can also be interpreted through linguistic meaning, concepts, or theories and from a physical or conceptual lens (Määttänen, 2015). Määttänen argued that this is because the mind cannot be separated from the body, which determines the viewpoint to the world. In other words, a teacher's actions are likely to signal how they are feeling about an activity, such as professional learning, or the teaching of curriculum concepts.

Another consideration when exploring the connection between perception and practice is the concept of habit. According to Määttänen (2015) "habits *as meaning* can only be applied to experience" (p. 32: emphasis added). For example, to make meaning and then enact curriculum concepts, teachers are likely to draw upon existing knowledge or seek to establish new understanding that can be defined as ritual, inert, conceptually difficult or alien knowledge (Meyer & Land, 2003; Perkins, 1999).

Ritual knowledge is described as being routine in nature (Perkins, 1999). Within technology education, this might be represented by a teacher who views the subject as being solely technical in nature and focuses on the manufacturing process and the development of quality outcomes. Inert knowledge can include information that can be retrieved as required but not used actively (Perkins, 1999). For example, experienced technology teachers are likely to value content knowledge that is associated with the function of materials and their properties.

The communication or construction of knowledge may become troublesome if teachers have difficulty making connections between curriculum concepts, with a view to integrating them into their practice. This could be because practitioners find curriculum content conceptually difficult,

potentially leading to misconceptions or causing a retreat to ritual knowledge (Meyer & Land, 2003; Paechter, 1995; Perkins, 1999). For some teachers, the knowledge being presented in the curriculum is totally alien to them, or they might not appreciate that the concepts being discussed are different to the way that they perceive the nature of the subject. These may advocate for knowledge in the curriculum that may conflict with their personal beliefs, or may be perceived as too conceptual, and they might not value it. The research of focus explored the differing perceptions of teachers, to determine how their experiences and school contexts influenced their engagement with the curriculum.

Theoretical framework

The current research used an interpretivist framework to acknowledge that reality has multiple perspectives, is socially constructed, and is holistic in nature. Interpretivists believe that there is no single answer or correct view of knowledge (Willis, 1995). The study was designed to be responsive to the field of interest, i.e. secondary technology teachers' understanding of the curriculum. An interpretivist framework accommodated the analysis of a phenomenon within two secondary school contexts (Reeves & Hedberg, 2003) to allow me to work closely with six technology teachers in the field (Cohen, Manion, & Morrison, 2011).

By adopting a sociocultural lens, there was an emphasis on technology teachers' practice, as influenced by the cultural contexts of their school community. According to Pajares (1992), theorists are in general agreement that enculturation and social construction can sometimes mean that individuals' perceptions differ from reality. Sociocultural theory was used to explore how teachers' perceptions influenced the ways that they made meaning of the technology curriculum and there was interest in the ways that individual professional development was affected through participation in sociocultural activity. Teachers' engagement during department meetings, for example, provided a means to determine what practitioners were finding troublesome in their understanding of the curriculum.

Teachers' differing understanding was explained through the notion of "liminality", to represent how teachers' knowledge was conceived and applied in practice and to explore whether teachers' thinking evolved or whether participants were unable or unprepared to achieve a transformed status (Meyer & Land, 2003); for example, teachers who are resistant to change can adopt a form of mimicry to give the impression that they are engaging with curriculum concepts as a means of coping with the constraints upon their practice (Ellsworth, 1997). Meyer, Land and Davies (2008) asserted that there are modal distinctions to offer insight into the differing understandings, which include the stages of subliminal, pre-liminal, liminal, and post-liminal ways of knowing. A teacher's way of knowing (episteme) can be the crucial factor to determine whether there is epistemological or ontological transformation (Meyer et al., 2008).

A subliminal variation is described as being reliant on tacit knowledge, which may be evident in the absence of any formal knowledge about a concept, and may be intuitive in nature. A teacher who re-enacts curriculum concepts in their classroom, without an understanding of their purpose, might reflect subliminal understanding. Alternatively, pre-liminal variation is evidenced when a concept is received. At this point, the receiver may choose to engage, resist or withdraw from the concept. This level of understanding might be manifested by a teacher who has been exposed to information in a department meeting and understands it. In their classroom, the teacher can then re-enact the concept, do so in a tokenistic fashion, or choose not to apply the concept at all. Liminal variation is the stage when learners have chosen to engage with a concept. It might be represented by how the learner interacts with a concept, to make meaning for application in a particular learning context. Finally, post-liminal representation is where a learner transitions a new conceptual space and can apply their understanding to future concepts as a result of a change in thinking. Liminality was pertinent to determine how teachers' perceptions and knowledge of the curriculum were conceived and influenced by their experiences and professional learning context.

Methodology

Naturalistic research draws attention to the notion of truth - in this case ethically and in relation to participants' beliefs about the nature of technology education. It was imperative for me to be accurate in my descriptions to represent the participants' truth by being consistent, neutral, and credible during my interpretations (Onwuegbuzie & Johnson, 2006). The accuracy of data was ensured through respondent validation where transcripts of all interviews and department meetings were sent to the participants, to confirm that the dialogue was a fair representation of discussions (Torrance, 2012). Respondent checks were also conducted at the end of the data collection phase in relation to the inferences that were drawn and the conclusions made about teachers observed practice (Bloor, 1978; Cohen et al., 2011).

By using multiple data collection strategies, a more convincing and accurate representation of the context was generated (Casey & Houghton, 2010). Data collection relied on several primary sources, namely *The New Zealand Curriculum* (MoE, 2007) and its supporting materials (MoE, 2010), two or three semi-structured interviews, non-participatory lesson observations, departmental meetings, teacher reflections, and teacher-generated resources. Triangulation by data type was used as a means to substantiate findings (Miles, Huberman, & Saldaña, 2014). A combined level approach to the triangulation of multiple sources was taken because individual, group, and organisational data were pertinent to the research focus. This mitigated the risk that there might be shortcomings with individual methods and facilitated propositions based on two or more methods of data collection (Lincoln & Guba, 1985).

Each teacher was interviewed at the beginning of the data collection phase to obtain baseline information about their teaching experience and to gain insight into their differing perceptions of the nature of technology education. Participants were asked to reflect upon their practice at the mid-point of the data collection phase. There was a final interview to ask further questions, gain clarification, and to confirm my impressions. This was significant because it provided participants with the opportunity to signal whether their thinking or practice had evolved throughout the data collection phase.

Two schools were chosen because of their convenient location (Creswell, Plano Clark, Gutmann, & Hanson, 2003; Merriam, 1998). Three of the six teachers were purposefully selected because they were known as being effective teachers of technology education. Three other teachers were volunteers and expressed an interest in the opportunity for professional learning that might support their evolving understanding of the technology curriculum. The data collection period spanned 18 months between the two school sites. Data analysis followed a traditional, sequential process whereby the data were collected, coded, and findings were interpreted (Miles et al., 2014). The stages of data analysis occurred concurrently with data collection (Cohen et al., 2011). The key themes of the research including teachers' perceptions, engagement with, and enactment of the curriculum, were used as a framework for analysis, and to present findings.

The schools and participants

The first school (Lakeside Academy) was known to be traditional in nature, with a newly appointed head of the faculty who had a nationally established reputation for her contributions to the subject over two decades. In contrast, the second school (Greenhill School) was newly established and the curriculum was to be constructed between teachers who had not previously worked together. The research participants are described below and pseudonyms are used when referring to the schools and participants.

Alice

Alice had been a teacher in New Zealand for 22 years. Most of her experience was based in one school but she had recently secured a new position as specialist leader of product design at

Greenhill School. She was known at a national and local level for her understanding of design, as applied in technology education.

Bernadette

Bernadette was an experienced New Zealand teacher, having been in the profession since 1990. She had been a teacher of workshop technology, design technology and more recently, technology education. Bernadette had a national reputation for her involvement in the development of the 2007 technology curriculum at both policy and practice level and had recently been appointed as the head of faculty at Lakeside Academy.

Colette

Colette was an Australian trained history teacher who had taught there for over 20 years. During that time she had developed an interest in working with wood and gained a Certificate in Cabinet Making so that she could teach design and technology. It was Colette's first year of teaching technology education in New Zealand (at Lakeside Academy).

Graham

Graham had been a chef before entering the teaching profession. He was currently in his third school and had been teaching for five years. His current role was as a specialist teacher of food technology at Greenhill School.

Helen

Helen was originally from South Africa, with a background in home economics. She had previously held a variety of roles there, as a technician in a University of Technology and later as a lecturer in home economics. Helen had worked at Lakeside Academy for five years teaching science, junior food technology and hospitality at [1]NCEA Level One.

Mike

Mike began teaching after a career in the military where he was an electronics specialist. He was the teacher in charge of digital technology at Lakeside Academy and was in his second teaching post.

Limitations

This research was limited to two schools and included the data from six participants. The intention was to report upon participants' views and practice in their schools, with a view to foster understanding about the ways teachers can be supported to evolve their practice, in a future-focused manner. The nature of teachers' professional engagement with the curriculum is limited to technology education. The results are very focused because this was a small-scale study but there are likely to be teachers in every learning area or school who engage with curriculum implementation on different levels – through sufferance or even with suspicion (Handal & Herrington, 2003). As a result of this research, there is the opportunity for educators to consider the findings presented for application in their own school setting.

Findings

[1] NCEA is the acronym for National Certificate in Educational Achievement and is one of the senior secondary school assessment frameworks in New Zealand.

Each teacher represented differing perceptions and could provide a rationale for their practice. Teachers were mediated by a variety of factors at different stages of their pedagogical processes and the key themes are organised in Figure 1 according to the guiding research questions, relating to teachers' perceptions, interpretation and enactment of the curriculum (MoE, 2007).

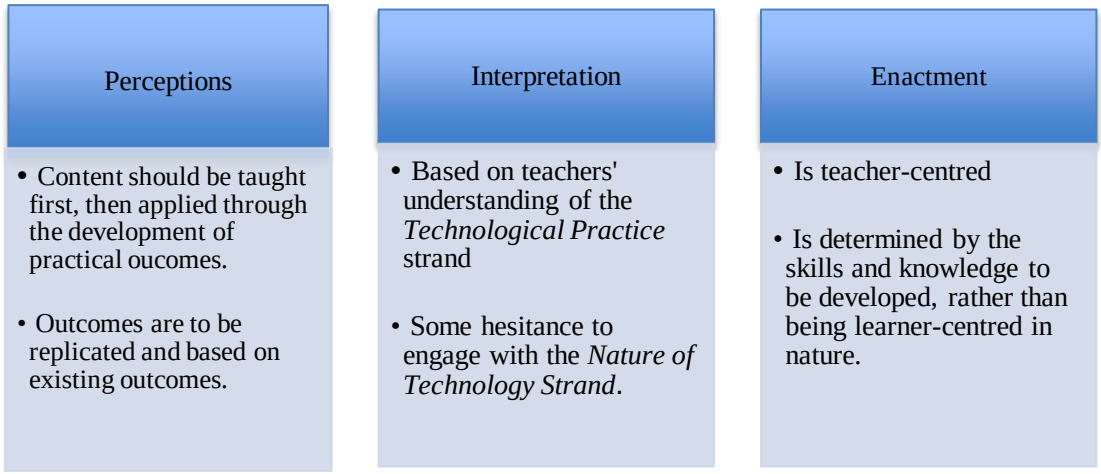

Figure 1. The key findings organised according to the research question

The participants' views emphasised a need to teach certain pre-determined skills to enable learning, which is reflective of the technical origins of the subject (Petrina, 1992). Participant teachers positioned the subject as being primarily about the development of competencies to enable the technical replication and development of quality practical outcomes. This was counter to a contemporary view that technology education can provide the opportunity to provide problem-solving activities, which encourage critical and creative thinking, and develop technological literacy (Williams, 2015; Zuga, 1989).

There were a variety of teacher perceptions - understanding is represented through the variations in liminal space and the knowledge that they found troublesome when interpreting or enacting the curriculum (Bell & Reinsfield, 2012; Chikasanda et al., 2011; Meyer et al., 2008). The next section discusses how teachers' understanding of the curriculum affected their engagement with the curriculum, and how this was manifested in their practice.

Alice

Alice described her perception of the nature of technology education and stated that at Greenhill School:

> Our focus [is] on sustainability, enterprise and empowerment and I think that has got a strong weaving of the nature of technology in there. We've [also] got the other [focus] which is innovate, design and make but really we've got explore how those two fit together.
>
> We really want to empower our students and make them understand that they have a voice in the technological process and that technology is not done to them or doesn't need to be done to them… (Baseline Interview E, Line 187)

In Alice's case, she reflected that if ideas for learning are:

> student generated, then they work and maybe that was the problem, I was saying we're making this car… They didn't come with the toolset and [then] you are always going to be beating your head against a brick wall with that. (Final Interview E, Line 227)

Alice was teaching a class about car manufacture and the knowledge she needed to enable this was, by her own admission, conceptually difficult for her (Meyer & Land, 2003; Perkins, 1999). It was not her understanding of the curriculum concepts limiting her practice but instead, her ability to support students' with the content knowledge needed within this particular learning context (Zuga, 1989).

Bernadette

Bernadette had a national reputation for her work during the development of the current technology curriculum and was positioned at the post-liminal stage of understanding. Her observed lesson indicated that she used habitual experience and knowledge to be responsive to students' academic learning needs in the classroom. She acknowledged that as the new head of faculty, her practice remained inert and ritualized in nature because she was tasked with supporting her colleagues' evolving understanding of the curriculum. This is where the knowledge she found troublesome manifested itself. During the department meeting, Bernadette provided examples for Helen, who she knew was experiencing difficulty in making sense of the curriculum, for her own specialist area of food technology. The examples Bernadette provided were confusing because she was unable to explain them in a manner that connected with Helen's understanding of the curriculum concepts. For example, during the department meeting, Bernadette stated:

> Okay, so if we were doing it on a pie we would be looking at why has a pie got pastry on the bottom and meat inside, what sort of flavours of meat are in it… we're looking at the bigger picture around why is a pie a pie and how has it developed and where does it fit in to what we do and what's influenced it and things like that. (Department Meeting LS1, Line 17)

In this example, Bernadette incorporated notions from both the Characteristics of Technology (CoT) and the Characteristics of Technological Outcomes (CoTO) components of the curriculum. Specifically, the pie example would address the CoT component if there were a discussion about how the product had evolved over time, and why pies had become so popular in the New Zealand context. The nature of the pie, including why it had developed to have pastry outside, and have different types of meat inside it would relate to the CoTO component, which considers fitness for purpose, physical and functional attributes, developed for a specific purpose, and within a social and historical context (MoE, 2007). Bernadette did not explain how teaching about a pie's technological development might address the particular components of the curriculum. The curriculum components were integrated in the example provided. This might cause confusion for teachers who do not have the necessary understanding to interpret the curriculum to make meaning of it, for their own learning context. If a head of faculty's knowledge of other specialist areas in technology (such as food technology) is alien to them (Meyer & Land, 2003, Perkins, 1999), there are likely to be implications when supporting colleagues' evolving understanding of the curriculum concepts.

Colette

Colette acknowledged that her knowledge of the New Zealand curriculum was evolving because she only been in the country for a short time. Her understanding was at a pre-liminal stage. She described her difficulty when engaging with some of the curriculum support material, and stated:

> So, the bulk of my understanding is from my cursory reading of Technology Online… I did find that the examples that were given seemed so beyond the reality of the classroom or were so specific to a particular subset of technology.
>
> So, [for] the nature [of technology] strand, it said examples [for students] would be talking about stem cell research...

> I thought, 'How am I going to make the leap from stem cell research to what we are actually doing in the workshop?' (Baseline Interview A, Line 283)

In this instance, Colette was experiencing difficulty separating out the meaning of the curriculum concepts from her own specialist content and within the learning context of "materials technology". The knowledge she needed to do this was alien to her at that point in the research (Meyer & Land, 2003; Perkins, 1999).

Graham

There was no evidence to suggest that Graham was experiencing trouble applying the knowledge that he needed to transition from a liminal space and deepen his understanding of the curriculum concepts for application in a range of learning contexts. Graham's data indicated, however, that his practice was being limited by the organizational structures within Greenhill School. His enactment was minimised by the need to engage his students in their learning within an integrated curriculum and under pressured timeframes. Graham explained that despite this motivation, his students were not interested in the initial learning focus that the teachers had pre-determined, and stated that to maintain some focus on food technology:

> We had to change everything around, we had a huge debate about what are we going to do and so we actually found the [2]Maggi competition and the boys were really into competitions and so we thought that we would give it a go…
>
> It worked out really well and within that, they had to develop an existing outcome and the brief was to develop a product for a specific need and so the students would recreate using a Maggi sachet.
>
> I wasn't happy about that but they used [the sachet] because it was part of the competition and they had to write to Maggi in their blog and upload their photos to the site and they marketed that to the wider school community. (Final Interview F, Line 171)

In this instance, Graham's intended practice had been required to accommodate another learning area's needs in a manner that positioned technology education as being useful for its practical nature instead of as a subject that provided valuable knowledge in its own right. Graham acknowledged that the new learning focus was counter to his perceived intent of the technology curriculum (Roche & Marsh, 2000). He was post liminal in his understanding of the curriculum but because of the constraints placed on his practice within an integrated curriculum, reverted to ritual knowledge (Meyer & Land, 2003; Perkins, 1999).

Helen

In Helen's lesson, she appeared to find the curriculum both conceptually difficult and alien (Meyer & Land, 2003; Perkins, 1999). Helen was subliminal in her understanding of the curriculum and was using Bernadette's resources to support her enactment. What appeared to be troublesome for Helen was the notion that students' practice in technology did not have to occur solely as the result of a replication of existing (food) outcomes. She appeared to have chosen not to engage in any meaningful way with the theoretical intent of the curriculum and taught the technological concepts by developing a template, which could be replicated for each of her junior school projects. When asked to consider whether her use of the curriculum had evolved during the data collection phase, she stated:

[2] Maggi is an industrial food company that originated in Switzerland in 1884, specializing in seasonings, instant soups and noodles.

> Generally no, I haven't changed it at all, it's [dependent upon] the units that go in and out towards the end of the year and how our time is and the disruptions and mostly it's the same, in the way that I present it more than anything.
>
> **Liz:** And have you tracked how that addresses the curriculum?
>
> Not formally. No. I don't seem to make the time to do it. You know, I've had a look at it and I know the importance of what I'm doing but perhaps the weakest part is the level for me. (Final Interview, Line 174)

Helen's practice gave the impression (during department meetings) that she was engaging with the curriculum when in fact, she was replicating others' ideas and continuing to practice in a manner that reflected historically placed practices (Paechter, 1995).

Mike

What Mike found troublesome was not the interpretation of the curriculum or indeed its enactment, but how he managed this process to record students' learning. He indicated a confidence that he was meeting the curriculum requirements but explained that there was a paucity of evidence to substantiate this. Mike asserted that whilst he might not explicitly cover particular curriculum concepts, he felt that students would intuitively develop understanding of technology as a result of the projects they engaged with. In this case, he was relying upon his ritual and inert knowledge (Meyer & Land, 2003; Perkins, 1999) and stated:

> ... I read that thing [the curriculum] and I go, [students] need to be able to do that and think, I've got an idea and I think I do start backwards, I do start with, they need to be able to do… then it's like, I have an idea about how to get [them] there and so I'm not always confident that the steps are there but I'm happy that if we meet at the end, we'll be there, but I couldn't tell you the staging posts, if that makes sense. (Final Interview D, Line 199)

Mike's data suggested a post-liminal understanding of the curriculum concepts but what he found troublesome was how to make explicit links between his knowledge, planning and practice. Figure 2 shows where each participant was positioned in relation to their liminal space and based on their understanding of the curriculum concepts.

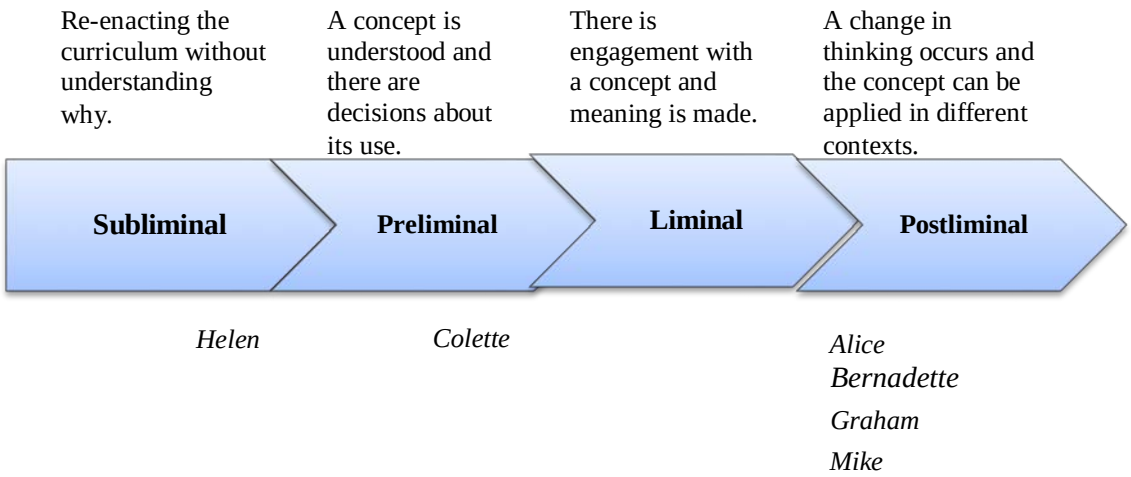

Figure 2. The liminal space positioning for participants
Source: Adapted from Meyer et al. (2008)

Alice explained that whilst she had a learning goal in mind (Stoll, Harris, & Handscomb, 2012), she had found it difficult to manage a large and challenging group of students who were working collaboratively on a class project. In this case, it was not Alice's understanding of the curriculum concepts limiting her practice but rather her inability to support the needs of her learners (Zuga, 1989). Mike was not developing his understanding of the curriculum but was instead basing his ideas upon his previous experience and what he determined students needed to know.

Bernadette acknowledged that as the new head of faculty, her practice remained inert and ritual in nature because she was tasked with supporting her colleagues' evolving understandings of the curriculum. It appears likely that there will be some challenges for curriculum leaders (in New Zealand) who do not have the knowledge of other teachers' specialist learning contexts in technology education. For Bernadette, the professional learning outcomes that she facilitated were moderated by the constraints of time available to her and the ways in which the curriculum might be interpreted as the result of the material being used to develop a technological outcome.

Colette's observed lesson demonstrated a technical approach to technology education and a focus on the development of craft skills (Hill, 2003; Zuga, 1989). Colette argued that rather than her enactment being constrained by her own understanding of the curriculum, it was the discourse in Lakeside Academy, which was reflective of elitist perspectives about the role of technology and the suitability of students for different roles in society (Hill, 2003; McLintoch, 1966; Reid, 2000; Williams, 2013). Conversely, the evidence suggested that the knowledge she needed to make meaning of the technology curriculum when interpreting other learning contexts was alien to her (Meyer & Land, 2003; Perkins, 1999).

Helen's lesson aligned with her view that the purpose of her teaching was to prepare students for their senior secondary pathway in Hospitality. She appeared to find the curriculum concepts both conceptually difficult and alien (Meyer & Land, 2003; Perkins, 1999). It appeared that Helen experienced difficulty in developing culturally appropriate pedagogical responses, which were contrary to those that she had experienced overseas (Glynn, 1998; Quezada, 2004; Sharplin, 2009). The next section discusses the findings.

Discussion

The participants all emphasised the need for students to produce quality outcomes, which was suggestive of a ritualized form of knowledge within their community (Meyer & Land, 2003; Perkins, 1999). Practical skills and knowledge of materials are important to students' understanding in technology but an overemphasis on the *Technological Practice* strand is likely to diminish the conceptual role that the subject should also embrace. An underlying assumption evident in the research, substantiated by the nature of the professional learning, was that the technological concepts in the curriculum would be interpreted as the result of teachers' specialized knowledge in their learning context. This supposition is significant and challenged as a result of this research.

Participants in this research (with the exception of Helen) acknowledged that technology education provides the opportunity to foster a learning environment that encourages problem-solving and the development of innovative outcomes (Osborne, 2016; Splitter, 2009; Zuga, 1989). The pervasive emphasis on the development of practical skills and replicated products contradicted this view, however. Teachers' practice was affected by their attitudes towards and understanding of the curriculum, subject leadership, and school structures.

For Alice and Graham, whose perceptions aligned with a contemporary view of technology education, the reality of a newly established school and the need to foster collegial relationships limited their ability to teach within a future-focused context. Both Alice and Graham reverted to traditionally placed pedagogies where students were told what and how to replicate an outcome was. Such practice positioned technology education as being craft-based in nature (Hill, 2003), leading to insights about why these teachers valued their specialist knowledge (Mutch, 2003;

Zuga, 1989). In this case, a failed attempt at realizing the curriculum in a contemporary manner made teachers hesitant to persist with new approaches (Greenberg & Baron, 2000); instead they maintained the status quo (Boyatzis, McKee, & Goleman, 2002; Fullan, 2002).

The ways that teachers engaged with, interpreted and enacted the curriculum led to an insight into the knowledge that they were finding troublesome. The research findings confirmed that there was a disparity between teachers' future-focused perceptions about the nature of technology education and their emerging practice. Whilst importance might be placed internationally on the development of technologically literate citizens (Williams, 2013), this research suggests other areas of emphasis in New Zealand secondary schools. The observed practice was teacher-centred in nature, and the context for learning was derived from teachers' specialist understanding rather than from the technological concepts and philosophy underpinning *The New Zealand Curriculum* (MoE, 2007).

Each teacher's understanding was connected to their experience of teaching technology, their engagement with the curriculum, and the school-based circumstances that were mediating their practice. The findings suggested that there were pervasive and historically based assumptions about the nature of technology education in both schools. Fortunately, the data also indicated that if technology teachers were motivated to challenge others' thinking, engage in dialogue about the subject, and support community understanding, these assumptions could be reconceived.

Learner-centred pedagogies

In order to move towards a future-focused approach to education, technology teachers first need to appreciate the benefits of learner-centred pedagogies and commit to such practice. Where teachers defaulted to traditional approaches for the teaching of technological concepts (in this research), pedagogy was not easily connected with the philosophy represented in the curriculum (MoE, 2007). If a teacher views the learning in a technology classroom as being their sole responsibility, dialogue and the engagement with technological concepts or even practical outcomes are more likely to be reflective of their own rather than the students' values (Williams, 2013). The challenge for teachers is that a learner-centred approach requires them to be responsive to and facilitate the development of knowledge and skills *as they emerge* in the classroom. Such an approach is dependent upon practitioners having the confidence, motivation, knowledge, and interest in accommodating a range of differing learning opportunities, from a variety of disciplines and in response to students' interests.

The use of responsive pedagogies can be moderated by teachers' attitudes towards the purpose of education and whether they see it as a means to develop citizenship, students' holistic development, occupational preparedness, or to respond to social and economic need (Adler, 1982; Le Compte & Marrais, 1992; Tyack, 1988). The practical skills and knowledge in technology education classes should not be pre-determined by teachers but taught "Just in Time" (JiTT) and as the result of student interest (Novak, 2011; Osmond & Goodnough, 2011).

JiTT is a pedagogical strategy that has been represented in e-learning platforms and can enable teachers' understanding of their students' learning needs, to improve academic outcomes and increase engagement within a discipline (Hughes, Luo, Kwok, & Loyd, 2008; Novak, 2011; Osmond & Goodnough, 2011). To facilitate this approach, however, teachers may need to review their perception of the subject's purpose. They might need to re-conceptualize technology education as a means to foster innovative thinking, rather than solely to develop practical skills.

The way that technology education is taught should not be solely bounded by the teachers' attitudes, values, judgments, or experiences but instead inclusive of the technological concepts (as presented in the curriculum) and the nature of innovation in society. To accommodate this approach, learning contexts will need to encourage creative and critical thinking, and provide opportunities to focus on learning that is future-focused in nature. This research indicates that the

ways that technology teachers' conceptualize their practice inevitably enables, moderates or limits their practice.

Transforming technology teachers' practice

There are a variety of factors influencing the enactment of a future-focused technology curriculum in New Zealand which are likely to require careful navigation. The review of the curriculum provides an opportunity to think differently about pedagogy and re-position students' learning in a more purposeful manner so that it can be inclusive of creative, innovative and critical thinking approaches,.

The future of technology education should be reflective of the connection between technology and society. It is accepted that to develop innovative technological outcomes, students need to understand the nature of materials or systems and be exposed to experiences where they can manipulate and adapt resources, to represent or realize their ideas. Technology education, therefore, can provide the opportunity for students to explore potential (conceptual, partially modelled or digitally realized) outcomes rather than solely emphasize the replication of existing thinking or products.

Technology might indeed be manifested as science fiction movies predict, with augmented reality or space travel becoming commonplace. To prepare students for such a future, technology teachers in New Zealand are likely to have to transform both their thinking and practice, to engage with contemporary technological issues rather than limit classroom practice to accommodate their existing skills or understanding. Inevitably, there will be a need to support teachers during this transformation, and professional learning should centre on the key curriculum concepts that technology teachers *need to know*, as well as a focus on *how to teach* these in a future-orientated way.

Conclusion

The research has highlighted a pervasive view that students should be taught content, as determined by teachers and as the result of the technological outcome that learners were developing. This finding was significant because it confirmed that technology teachers' perceptions of the nature of the subject were closely connected to their previous professional experiences, which in turn influenced their interpretation and enactment of the subject. The knowledge and skills in each teacher's specialist area of technology education took precedence over the curriculum concepts in both school contexts. There were few explicit examples where teachers focused on the development of students' conceptual understanding of technology education. Interestingly, innovative teaching appeared to be most effectively enabled by a teacher's attitude towards learning-centred pedagogies.

The findings also highlighted that school-based professional learning experiences relied on assumptions about teachers' understanding of the curriculum. Where there was exposure to new concepts, professionals' responses were manifested as hesitation, replication, or resistance to engage with the curriculum in a meaningful manner. There are implications here for both teacher education and future-focused pedagogical practices.

Recommendations

The research reported upon here suggests that there are some constraints upon teachers practice, causing troublesome knowledge as manifested through their understanding of the curriculum, and commitment to learner-centred pedagogies. To transform their practice, technology teachers will be required to engage with contemporary technological issues in society, rather than retain, or default to, practices that emphasize practical over conceptual outcomes. To enact the revised curriculum (MoE, 2017), there will be a need for teachers to cater to students' interests, and support a future-focused approach to education. Such an approach will require sustained

professional learning, to realize the vision that students should become informed citizens who can participate in, and be responsive to, the uncertain nature of society.

This research has implications for both emerging and experienced technology teachers in New Zealand who are motivated to teach the curriculum from a contemporary or future-focused perspective. During professional learning experiences, technology teachers should be supported to develop their understanding of learner-centred pedagogies. There should be an emphasis on contemporary practices, which advocate for negotiation between the teacher and student, to develop technological knowledge and skills, fostered at a time that is most meaningful for the learner and as an iterative part of a technological process. There is a persistent need for practitioners to understand the nature of technology and its interaction with society as it relates to the concepts in the curriculum. Further research is necessary to determine how technology teachers might apply future-focused approaches to learning in a secondary learning context, to foster learners who are positioned to use their existing knowledge in a technologically mediated world.

Afilliations

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