Waikato Journal of Education

ISSN 2382-0373
Website: http://wje.org.nz

Wilf Malcolm Institute of Educational Research
Te Pūtahi Rangahau Mātauranga o Wilf Malcolm
THE UNIVERSITY OF WAIKATO

Title of Issue/section: Volume 23, Issue 2, 2018

Guest Editor: Dianne Forbes

Editor: Noeline Wright

To cite this article: Reinsfield, E. (2018). Secondary technology teachers' perceptions and practice: Digital Technology and a future-focused curriculum in New Zealand. *Waikato Journal of Education, 23*(2), 61-74. doi: 10.15663/wje.v23i2.655.

To link to this volume: 10.15663/wje.v23i2

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Waikato Journal of Education
Te Hautaka Mātauranga o Waikato

Volume 23, Issue 2: 2018

Secondary technology teachers' perceptions and practice: Digital Technology and a future-focused curriculum in New Zealand

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Abstract

The Technology Learning Area statement in the New Zealand Curriculum has been recently reviewed to prioritise Digital Technology as a context for learning (Ministry of Education (MoE), 2007, 2017a). The emphasis provides the opportunity for teachers of technology education to guide learning in a future-focused manner, whilst also accommodating their students' social and academic needs. Four potential school-based responses are proposed, which are asserted as being likely to emerge from this recent change. Findings from a qualitative research project inform discussion about how secondary technology teachers' perceptions and interpretation of the Technology Learning Area curriculum statement can have an impact on their practices. The implications are discussed in relation to how teachers' practice can be affected by the discourse within which they teach, and to assert that a personalised approach to professional learning is necessary to enable a future-focused Technology Learning Area curriculum.

Keywords

Digital Technology; curriculum, future-focused, teacher perceptions, technology education.

Introduction

This article reports upon one aspect of research findings that explored how six technology teachers' perceptions of the curriculum influenced their interpretation and enactment of Technology in the *New Zealand Curriculum* (MoE, 2007, 2017a). The article focuses on data from one participant, a Digital Technology teacher whose views highlight some existing tensions for practice in his secondary school context. It is likely that these views will influence the subsequent enactment of a future-focused curriculum. From the findings and implications from the highlighted tensions, I advocate for a more personalised approach to professional learning in technology education.

A future-focused curriculum

The term future-focused is used here, in an educational context to describe the New Zealand Government's agenda for pedagogical practice that fosters students' digital fluency. Teachers in New

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Zealand are increasingly encouraged to adopt a future-focused approach to education, within learning communities that are flexible in their approach to teaching, situated within open and adaptable learning environments, and embracing digital pedagogies (Leggat, 2015; MoE, 2016; OECD, 2013). Policy documents like the New Zealand School Property Strategy for example, assert that Innovative Learning Environments are a means to develop "a world-leading education system [able to provide] all New Zealanders with the knowledge, skills and values to be successful citizens in the 21st Century" (MoE, 2011, p. 2).

For those teachers who embrace the changes to the technology curriculum, there are opportunities for their practice to look very different, with virtual and 'on demand' approaches becoming commonplace (Nikirk, 2009). The Ministry of Education (2017b) indicates that school infrastructures are in place to support digital pedagogies and situate a future-focused curriculum that centres on learner agency, active engagement, collaboration, creativity, risk-taking, experimentation, and inquiry (Wright & Forbes, 2015). Whilst such emerging trends can be observed in some secondary schools, the capacity for students' engagement with digital learning appears dependent, however, upon funding issues, organisational structures and teacher capability (Melhuish, & Falloon, 2010; Mumtaz, 2000; Wright, 2010).

The Technology Curriculum

The current iteration of the *New Zealand Curriculum* (MoE, 2017a) accentuates the role of Digital Technology as a learning context in Technology Education. The curriculum review is espoused

> to ensure that all learners have the opportunity to develop the confidence and skills they need to use digital technologies and to design and build digital systems… that young people are digitally capable in all aspects of their lives and careers, whatever pathways they choose (Education Gazette, 2017a, para. 2).

Increasingly, the academic success of students as citizens is associated with their digital fluency. Digital fluency is associated with skills and proficiency in using digital tools as a means to assimilate, evaluate and reintegrate information in a deliberate manner (Attwell, 2007; Berson & Berson, 2013; Education Gazette, 2017b; Glister & Glister, 1997; Jones & Hafner, 2012; MoE, 2017b; Prensky, 2012; Wenmoth & CORE Education, 2016; White, 2013).

Digital Technology is a technological area replacing the formerly named Information Communication Technology (ICT). Digital Technology can situate students' learning through their engagement with the three strands of Technological Practice, Technological Knowledge and the Nature of Technology. The Technological Practice strand addresses concepts that inform the design and development of digital systems or products, such as a website. The Technological Knowledge strand addresses principles that inform the use of digital technologies, such as computational thinking. Computational thinking can manifest as learning that requires students to organise actions into systematic or logical stages, such as coding (Mohagheg & McCauley, 2016). The Nature of Technology strand focuses on the relationship between societal need and technological development (MoE, 2007; Reinsfield, 2018).

The renamed technological areas are illustrated in Figure 1.

Figure 1. The technology areas in the New Zealand Curriculum (MoE, 2007, 2017a).

Digital Technology, like the other learning contexts in technology, has evolved from having technical origins, where there is a focus on the processes and/or stages underpinning a product's development. Digital Technology now includes a wider vision, which is increasingly future-focused (Bates, 2001; Steeples, Jones & Goodyear, 2002; Welsh, Wanberg, Brown & Simmering, 2003; Wright, 2010). Educators in New Zealand are required to teach technology education from Years 1-10 (Age 5-14). As a result of various factors, including teacher perceptions of the purpose of the subject, curriculum content can be minimised to a focus on the development of students' technical skill - in this case, the use of digital tools. Instead, the subject should be represented through a combination of technical and technological thinking, as characterised by an iterative approach to critical, creative, problem-based learning (Reinsfield & Williams, 2017; Reinsfield, 2018).

As a result of this new curriculum emphasis, there will be an increased need for teachers to teach technology education in a manner that reflects a future-focused approach to learning. This identified focus is likely to be challenging for some teachers because it will require them to de-emphasise the technical nature of the subject and instead extrapolate students' conceptual understandings by engaging in future-focused pedagogies (Reinsfield, 2018). This will inevitably cause tension for some practitioners who appear to be already struggling with the way that the subject is conceptualised, to accommodate the

> …rapid pace of technological advancement and global connectivity [which] has prompted further calls mandating the revision of current education practices to meet and shift futurist predictions and ideals about how young people prepare for and engage with their futures (Cowie & McNae, 2017, p. ix).

Realising change

Most current secondary school students have grown up with digital technology as an integral part of their lives. However, while they engage with a technologically-mediated world for personal reasons such as using various social media, this does not necessarily translate to their learning in technology education (Becker, 2000; Bennett, Maton, & Kervin, 2008; Kozma, 2003; Lai & Hong, 2015; Lorenzo & Dziuban, 2006; Ng & Nicholas, 2013; Nikirk, 2009; Wright, 2010). Equally, teachers' use of digital technologies does not necessarily represent contemporary approaches to learning, students' familiarity with, or availability of resources (Kennedy, Judd, Dalgarno & Waycott, 2010; Lai & Hong, 2015; Oh & Reeves, 2014; Selwyn, 2009). In this climate of curriculum change, there is a risk that teachers will experience difficulty if they are required to develop a digitally fluent practice, whilst also ensuring that classroom learning accommodates students' social and academic needs (Levin & Arafeh, 2002; Prensky, 2005).

According to the *Education Gazette*, the Digital Technology aspect of the curriculum should be nationally embedded in schools by 2020. It will be supported by a National Readiness Programme, professional learning and development opportunities, and exemplars for teachers' use (Ministry of Education, 2017c). My research suggests, however, that some secondary technology teachers are already experiencing difficulty when making meaning of the curriculum. This is because their perceptions of the nature of the subject of technology do not easily align with the way that it is conceptualised in policy, or how it is represented in their school. Personalised approaches to professional learning are necessary to accommodate the diversity of teachers' experiences and perceptions. This personalised approach is most likely to influence a positive change in thinking and practice (Reinsfield, 2018).

Professional learning in New Zealand

In New Zealand, educators are encouraged to use inquiry-based professional learning approaches to navigate any contextual challenges within their school. Teacher inquiry is identified in the professional standards, communicating an expectation that learning about and from practice should be embedded in an evidence-informed professional practice (New Zealand Education Council (NZEC), 2017). There appears to be an assumption that teachers are well positioned to determine their own professional learning needs and that schools provide the organisational structures to offer collegial support as necessary. Further change to the curriculum indicates that some teachers will require differing levels of support, as determined by their current understandings and perceptions about technology education.

There is a paucity of literature to describe how technology teachers engage with or take responsibility for their own professional learning in their own school context, or for their emerging practice. In the technology education community in New Zealand, there has been a tendency for passive professional development models in which teachers rely on others to inform them of how their pedagogy should manifest (Granshaw, 2010). To be adaptive practitioners in technology education, however, teachers are required to gauge students' conceptual and real-world understandings to facilitate deep learning opportunities (Allen, Webb, & Matthews, 2016). In such learning contexts, technology teachers need sound pedagogical knowledge and commitment to a responsive, constructivist approach to teaching (Goodwin & Webb, 2014; Saxton et al., 2014). In technology education, teachers can provide opportunities for students to construct their own knowledge, as a result of their shared learning experiences (Kirschner, 1992). The same approaches can be applied to professional development models, assuming that teachers are motivated to make a sustained and personally meaningful change.

Research methodology and design

My research explored how six technology teachers' perceptions influenced their interpretation and enactment of Technology in the *New Zealand Curriculum* (MoE, 2007). The study was interpretive, socio-cultural, and qualitative in nature and designed to explore each teacher's understandings, circumstances, and experiences when teaching technology education. This was appropriate because technology education has the potential to be taught differently in every school and classroom in New Zealand. There was a deliberate focus on teachers' perceptions and their consequent engagement with, and meaning-making of the technology curriculum.

A case study is a suitable methodology for one or several areas of interest, to consider complex and contemporary issues from a variety of perspectives, and to illustrate multiple realities (Duff, 2008). This method was thus appropriate for my study. Data were collected through teacher interviews, lesson and department observations, and the collection of teacher-generated resources. Activity theory was the interpretive framework used to analyse the data because it accommodated a lens on the mediation of human activity through physical and psychological tools (Cohen, Manion &

Morrison, 2011; Drever, 1995; Engeström, 2001; Leont'ev, 1978; Lincoln & Guba, 1985; Maxwell, 2005).

Research limitations

The research was conducted in two schools with six participants. The nature of teachers' professional engagement with the curriculum was limited to technology education. The findings are consistent with other studies' reports, which indicate that it is critical for teachers to consistently reflect and develop their curriculum understandings and knowledge for practice (Akiba & Wilkinson, 2015; Jones et al., 2013; Williams et al., 2015).

Findings

The findings from this research identified that teachers' practice was influenced by their values and beliefs, their pedagogical aims, perceived roles, understandings of curriculum discourse, as well as how they made meaning of the curriculum for their school context. I will concentrate on the findings from Mike, a Digital Technology teacher in my research. His circumstances and perceptions of technology education are outlined.

Mike began teaching after a career in the military where he was an electronics specialist. He was the teacher in charge of Digital Technology in a secondary school department, which valued the progressive and innovative nature of Technology Education. Learning in this school was reported as being focused on the development of students' independent and critical thinking skills. Mike wanted to be involved in my research to gain affirmation that the work that he was doing adhered to the curriculum requirements (MoE, 2007). The data collection occurred before the curriculum was reviewed.

During his baseline interview, Mike was asked to describe his perception of technology education. He referred to the positioning of Digital Technology in the 2007 iteration of the curriculum, stating that many of his colleagues felt that the learning context was not a natural fit. He perceived a need to foster collaborative relationships with teachers in other schools because he was the only Digital Technology teacher in his school and his colleagues did not understand how the technological area should be enacted. Mike communicated strong beliefs about the purpose of Digital Technology and described a focus on learning that emphasised the development of life skills (Reinsfield, 2018). He acknowledged the creative nature of the subject, explaining that a student's open and investigative mind was more important to him than an ability to develop a fully functioning technological outcome. Mike perceived that national curriculum development had affected the way that the technology education was perceived, stating that it had

> … Undergone a lot of changes in the time since I went to Uni. [Digital Technology] was always seen as "the typing pool". Technology was seen as the dumping ground. Badly behaved kids used to get sent down there… A lot of schools have struggled to come to terms with the fact that actually it's an academic subject and that [the] skills taught are huge. I think a few Principals have struggled with that one, big time. I think it's inherent from their childhood. They just can't move outside that box. But it's changing. The perceptions are changing; things are getting there... And I like that New Zealand has said we want it to be there. Albeit painful on the teachers' part! You've got to face the pain at some point. *(Laughter)*... (Baseline Interview D, Line 194)

During the three interviews, Mike communicated confidence with the concepts from the broader technology learning area and could make connections between these and his area of Digital Technology. This was demonstrated during the observed lesson through project-based learning, in which he asked students to conceptualise and then develop a website based on their interests. Mike described how he planned for his students' learning, stating that

> I just have ideas, they pop in there, usually in the shower, … I'm not a great one for all the detail, I'm really bad at all of the paperwork, the reports and the tracking but when it comes to the idea and the "Let's make", I'm one of those teachers. (Final Interview D, Line 288)

Mike emphasised the importance of content knowledge in Digital Technology and reflected upon the nature of the learning in his classroom, stating

> …Some kids like the structure, they like to know what box do I tick next? And some kids don't want that. So, in the old days, we spent a lot of time looking at attributes and expectations. Whereas now with agile programming, or [an] agile method, they'll make something, review it, make it, review it, make it, and review it.
>
> So you're working on your product all the time [whilst] you're still planning it. You don't have this big planning phase and then the making phase. You have to make, and plan, and do – all at the same time.
>
> I think it's allowing them to choose their own topics. It's hard work – that's really hard. (Baseline Interview D, Line 346)

Mike described an iterative approach to technology education with his Year 9 Digital Technology students, where there was an expectation that they justify their decision-making processes, and develop their skills in self-regulation. Mike stated

> …So even at [Year] 9 now, they do a little website project on PowerPoint, on what you want… "You choose a topic". And again, we're starting to get much broader things. So we're trying to teach them about time management and ownership from Year 9...
>
> And they have to have that ability. Otherwise, we're not preparing them for life. And you can't teach it on a board…they have to experience it, and they have to experience failure… and you try and teach them that failure's not failure. Failure is a learning curve. (Baseline Interview D, Line 179)

Mike used a range of strategies to engage his learners during the observed lesson, where he stated

> Today then, we're going to start our web design project. We're going to create a prototype… now, why do you think people would create a prototype? And why would you want to create a website prototype?
>
> (*Teacher repeats student's answer*)... To test it out to see if it will be successful. Yes, exactly... Now, secondly... if we're making a prototype, to test stuff out, to make sure we don't stuff up the real one, why would we make a prototype website? Why would we do that, do you think?
>
> … So in PowerPoint, you can create a mock-up of a website. It can have hyperlinks, buttons, graphics, video, it can have all the things that a website has, without the coding. (Lesson Observation D, Line 43)

There were pervasive and historically based assumptions about the nature of technology education in Mike's school and Digital Technology appeared at odds with the other technological areas. This is a significant finding, because for teachers to feel empowered to review their practice they need to have a sense of professional identity and a shared vision within their subject community. The research data from six teachers across two schools confirmed that if technology teachers were motivated to challenge others' thinking, engage in dialogue about the contemporary nature of the subject, and support evolving community understandings, there is the opportunity for sustained change.

The implications

My research findings suggest there are persisting tensions that are affecting technology teachers' practice in the secondary school context. To enable the required curriculum change, teachers will have to be committed to dynamic learning approaches, which enable students' participation in a developing global and digital community (Dakers, 2016; de Vries, 2005; Feenberg, 2006; Wallace & Hasse, 2014). There will be an ongoing need for sustained, personalised, and context-specific professional learning, to consolidate both teachers and the community's understanding of a future-focused approach to technology education.

Community expectations of technology education can represent an outdated view, perpetuated by the circumstances where students are completing projects that their parents did when they were at school (Barlex, 2016). The way that technology education is perceived can also still be determined by its technical roots, which can become prohibitive in some school contexts (Reinsfield, 2018). The outlined concepts in Table 1, adapted from Barlex's (2017) work, propose ways that schools might respond to the recent change in the New Zealand curriculum and the potential implications for institutions.

Table 1. Four potential implications for the enactment of technology curriculum in New Zealand

	The nature of the subject	**Application**	**Resource needs**
Implication 1	The school curriculum becomes future-focused and integrated into nature	All students and teachers will engage in a future-focused curriculum from Years 1-13, to foster the community's digital fluency	Sustained upgrade or maintenance of school facilities. Professional development on a sustained scale. There is an expectation that teachers are digitally fluent to fulfil their professional responsibilities.
Implication 2	Technology education leads an integrated and future-focused curriculum	Teachers provide a future-focused curriculum from Years 1-10 in technology education	Lesser need for facility upgrades and maintenance. Professional development on a sustained scale for some teachers. There will be an increased demand for digitally fluent teachers.
Implication 3	A future-focused curriculum is the sole responsibility of Digital Technology teachers	Applies to teachers with an interest or expertise in Digital Technology	A lesser need for facility upgrades. Some ongoing professional support required. A continuing demand for teachers who are digitally fluent.
Implication 4	A future-focused curriculum is marginalised to become technical in nature.	Students' learning experiences are centred upon the use of digital tools instead of digital fluency.	Limited need for an upgrade in school facilities. Minimal need for a change in most teachers' practice or for teachers to become digitally fluent.

In New Zealand, there is an ongoing tension between curriculum policy and practice, and any of the above outcomes could manifest in a school, for a variety of reasons. There are a number of constraints for teachers committed to the teaching of a future-focused curriculum in an uncertain climate of technological development. A future-focused curriculum should be available for all students, however, and taught in a manner that accommodates their academic or social need (Reinsfield, 2016, 2017, 2018). It is asserted here that the responsibility for developing students' digital fluency requires a

whole-school approach. Implication one (Figure 1) represents a solution, where the school can prioritise professional learning that supports teachers' understanding of a future-focused curriculum. It also requires the most significant resource implications.

The revision of the New Zealand curriculum (MoE, 2017a) presents exciting opportunities to support students' towards their engagement with a technologically-mediated future. Each school will cater for this change in the curriculum differently, and according to staffing expertise and the resources available to them. Inevitably, teachers will be required to engage in professional learning, particularly when they need to become digitally fluent themselves. The next section proposes a professional learning model that could facilitate this process.

A proposed professional learning model

The following professional development model, developed as a result of my research findings, provides teachers with a choice as to whether they prefer to combine external and school-based professional learning. The model is designed to accommodate teachers need to navigate organisational challenges whilst also enabling a responsive approach to pedagogy. The intention is to build sustained teacher capability in technology education. Table 2 provides a structure for the professional learning, including the identified characteristics that may limit teachers' thinking and enactment of the technology curriculum. The key curriculum concepts are presented to indicate what practitioners are required to address in their teaching of technology. Professional learning strategies are suggested to support the development of curriculum understandings and facilitate the development of evidence that reflects how their practice aligns with the professional standards for teachers in New Zealand (NZEC, 2017).

Stage one

During professional learning and to enable a sustained change in practice, a teacher's perceptions of the nature of technology education need to be understood. During professional learning, teachers can engage with activities that encourage them to form new connections between the curriculum concepts and its meaning for learners. The professional learning model is designed to support and model self-regulatory approaches to facilitate this developing knowledge and dispositional change process. The intention is that teachers will foster greater autonomy with their professional learning, as it occurs. By encouraging teachers to become self-regulating during their professional learning experiences, they are more likely to critically analyse their performance in a meaningful and sustained way. This professional learning model encourages self-analysis, self-reflection and self-observation (of emerging practices) with a view to developing self-efficacy - the belief that one can realise professional goals.

Stage two

With the introduction of new professional standards, there is likely to be some unease within the educational community in New Zealand (NZEC, 2017). The proposed model is designed to focus on five of the six professional standards and is intended to provide a framework that can address an identified disparity between technology teachers' theory and practice. Goal-setting tasks can make teachers more motivated to succeed and develop their professional identity because it can be self-directed and focused on their self-efficacy (Zimmerman, Bandura, & Martinez-Pons, 1992).

Table 2. A professional development model, to support teachers' evolving digital practice

Stage one: **Teacher characteristics and inquiry questions**	***How do teachers*** Value knowledge? Interpret the curriculum? Perceive the relationship between technology and society? Use pedagogical strategies to model the use of digital tools? Adapt their practice, to accommodate students' needs?
Stage two: **Link to teachers' professional standards (NZEC, 2017)**	**Teachers can provide evidence of** Engagement with *professional learning* through inquiry, collaboration, problem-solving, to improve student outcomes Establishing and maintaining *professional relationships*, to improve students' learning outcomes Fostering a *learning-focused environment* *Designing learning* that makes explicit connections to the curriculum by using pedagogical practices that responds to students' technological needs *Teach* in an informed and adaptive manner.
Stage three: **Professional learning strategies to revisit the teaching of key curriculum concepts in technology (MoE, 2007, 2017)**	***Teachers can engage in*** Self-assessment and goal setting Meaning making of the curriculum, from a future-focused perspective Anchored instruction Individual or collaborative inquiry Critical reflection and problem-solving. ***Students need to learn*** The conceptual and practical nature of technology education How to develop technological outcomes in a creative and critical way How to respond to societal need and make informed and ethical judgments In an iterative manner

Stage three

To honour the intent of the curriculum, teachers' professional understandings should be supported through constructivist means. According to Brooks and Brooks (1993), there are four principles that align with a constructivist approach to learning, including:

- Seeking and valuing the learners' point of view;
- Challenging learners' suppositions and either validating or transforming their truths;
- Discussing emerging issues or relevance of the learning to support the creation of personal meaning;
- Contextualising the learning to focus on the bigger picture, with mediation from the more knowledgeable other (p. ix).

Teachers should be provided with the autonomy to choose interventions that suit them, as they require them. To establish teachers' understandings of technology education, for example, discussion about their practice will generate information about how they use the curriculum concepts to inform their teaching. If teachers understand the purpose of learning as conceived in the curriculum, they are more likely to design deliberate interventions and apply their understandings within different learning contexts (MoE, 2007, 2016; Wiggins & McTighe, 2006).

Having established teachers' knowledge of the technological concepts in the curriculum, they can engage in anchored instruction, to explore a future-focused issue of their choice, within a simulated environment. The intention is that by experiencing this themselves, they are more likely to see the benefits of such an approach in their own classroom. Anchored instruction can foster an understanding of a new concept, to acknowledge perceptions and accommodate differing understandings (Bransford, Sherwood, Hasselbring, Kinzer & Williams, 1990). The stages of anchored instruction can be aligned with the expectation that a teacher will take increasing ownership of their professional learning, as it progresses. According to Baumbach, Brewer and Bird (1995), there are six key decision-making points that can define anchored instruction. These include

- Choosing the anchor
- Developing shared understandings of a technological concept from the curriculum
- Expanding the anchor, by developing strategies to engage learners
- Teaching with the anchor, in a learning context
- Teacher exploration into the effectiveness of the intervention
- Sharing with colleagues what has been learnt and reflecting on the learning outcomes.

These key stages are proposed here as a means to support technology teachers' evolving pedagogies. The anchor in this context will be negotiated with the teacher, based on what they know, find troublesome, or wish to explore further. Within this model, for example, there might be a partnership between academics, teachers and members of industry to establish a climate to foster transformative practice that will address technological need within real-life contexts. This is distinct from other professional development models being offered to technology teachers, which generally communicate others' best practice. Such models are beneficial for those who can make the connections between the best practice and their own. There is a risk, however, that such an approach could further marginalise those teachers who are experiencing difficulty in establishing or consolidating their identity in an ever-evolving profession, for it appears to operate from a deficit view of teachers' current practices.

Fostering partnerships is imperative to being responsive to new and emerging challenges in education (Cowie & McNae, 2017). Teachers need to be agentic in this process so that they can enable change in their schools, particularly when making meaning of the curriculum in response to their students' needs (Mitra, Lewis & Sanders, 2013). To encourage innovative practice and counter resistance to change, the proposed professional learning model will support and acknowledge the place of a teacher's current educational practice (Persellin & Daniels, 2015).

Conclusion

The emphasis of the Government's agenda and the recent change to the curriculum presents an opportunity for teachers of technology, and especially Digital Technology teachers, to think differently about pedagogy in New Zealand. There are a variety of factors influencing the enactment of a future-focused technology curriculum and many of these suggest a continuing and sustained need to challenge the existing perceptions in a school's local community to support teachers' evolving professional understandings. This article proposed four potential outcomes of the recently revised technology curriculum in New Zealand and recommends a professional learning model to support teachers to mediate a change in pedagogical thinking and practice in technology education.

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