The Mātanga Project

Developing a Self-Sustaining Model for Technology Teacher Education for and within the New Zealand Community

Elizabeth Reinsfield and Wendy Fox-Turnbull

This paper outlines a study aimed at exploring the Mātanga (Māori term for expert) project, a professional learning and development (PLD) programme designed to foster and sustain teachers' engagement with the technology education curriculum in New Zealand. The programme provides a response for technology teachers to develop their specialist identity by focusing on the notions of technological and technical thinking. The Mātanga project is led by expert teachers (Mātanga), for Early Childhood, Primary and Secondary technology teachers. It aims to reposition the agency within the professional community and support participants to feel more connected to local, regional and national support, through digital networks. Situated within a qualitative interpretivist framework and through a socio-cultural lens, the data analysis was based on the perceptions, experiences and evolving understandings of Mātanga (n=9), and participant teachers (n=12). Thematic analysis allowed for the extraction of meaning and reporting of emerging knowledge, as informed by existing literature on contemporary approaches to PLD in technology education. Early findings suggested that the participants who gained most from the project were digitally confident, and experienced regular and purposeful interactions between Mātanga and participants. Further findings identified that Mātanga perceived a need to develop their own mentorship skills and thought that this would strengthen the effectiveness of the project. The project positively impacted individual teacher's subject identity and practice, which in turn will inform the evolving nature of technology teacher education, and the potential for self-sustaining models of professional learning and development in the future.

Keywords: New Zealand; professional learning and development; teacher identity; technology education; thinking.

Introduction

New Zealand teachers are expected to be lifelong learners who are committed to developing their understanding of contemporary pedagogical practices (Ministry of Education (MoE), 2007). Factors enabling teachers' evolving professional knowledge might include a collaborative community, focusing on continuous improvement, internal and external partnerships, effective leadership, time to reflect and critically analyse one's own practice, sound knowledge of pedagogical practice for application in differing learning contexts, and a safe environment to take risks (Fullan, 2002; Glaser, 1984; Hargreaves, 2000; Hargreaves & Fink, 2004; Harris, 2002; Koehler & Mishra, 2009; Le Fevre, 2014; Louis, Marks & Kruse, 1996; Putnam & Borko, 2000; Shulman, 1986, 1987; Timperley & Philips, 2003).

When engaging in externally provided professional learning, teachers are often provided with information, which they are then expected to make sense of to inform their local curriculum (Gravani, 2007; Hawley & Valli, 1999; Murrell, 2001). In a climate where teacher learning is expected to be a continuous process however, there is a need for practitioners to inquire, and engage in needs-based professional development, so that they can build upon existing experiences and understanding. This learning process should be acknowledged as social in nature and professional development needs to directly connect curriculum thinking with practice (Garet et al, 2001; Webster-Wright, 2017). By

necessity, this learning process has increasingly become collaborative in nature, and requires the fostering of connections across networks, so that ideas, assumptions and practices can be developed, challenged, and changed, as appropriate.

Online approaches to learning provide an accessible way of enabling equitable professional development, which is significant because New Zealand technology teachers can work in isolated areas of the country, and are at times the only curriculum specialist in their school. Connectivism is a theoretical framework for understanding online learning and can be a means to support teachers to think differently, or to foster new understandings through the use of information technologies (Siemens, 2014). Online platforms can provide discursive learning contexts, to accommodate the sharing of diverse views from colleagues outside of teachers' immediate school community, thus extending the scope of their evolving understandings (Kear, 2011; Lai et al., 2013).

The Mātanga project

The Mātanga project was designed to acknowledge that teacher perceptions and dominant discourses influence the way that professionals interpret, make meaning, and develop their professional identity or practice, within their own community (Biggs, 2006; Brookhart & Freeman, 1992; Dakers, 2006; de Vries, 2005; Fox-Turnbull & Sullivan, 2013; Hoyle, 2008; Kadi-Hanifa & Keenan, 2016; MacGregor, 2017; Zlatković et al., 2012). This is particularly pertinent because of recent changes to the technology curriculum in New Zealand, which include an increased emphasis on digital technologies (MoE, 2017a). Specifically, the revised aspects of the technology curriculum include notions of computational thinking and designing and developing digital outcomes.

In recent times, professional learning and development has been funded, driven and determined by the Ministry of Education (2017b) to meet its priority goals. Whilst laudable, this has fostered a climate where the opportunities for needs-based PLD have been marginalised (Forret et al, 2013). Teachers' agency has been diminished and as a result, in technology education, practitioners' evolving curriculum understandings, professional identity, and consequent practices are less likely to be responsive to emerging needs – both their own and that of their students.

Mātanga were the PLD project facilitators, who were self or peer identified experts in technology education. Each Mātanga was allocated three or four teachers to work with during the year. These pairings were determined by the Mātanga' area of expertise within technology education, and the needs of their participants. A key aim was to foster teachers' sense of belonging and connection to technology education in New Zealand.

Teacher identity and ways of thinking

Teachers' perceptions about the nature and purpose of technology education can be represented in diverse ways. In New Zealand, the subject reflects a confused identity with some teachers reverting to historically placed practices (Reinsfield, 2016). Teachers' connection to their professional community and evolving specialist identity can be strengthened through their understanding of the nature of technology education and their emerging practices. The Mātanga project was designed to acknowledge that when technology teachers are expected to teach in a manner that is different to their usual practice, tensions can manifest between their professional identity and professional practice. (Biggs, 2006; Dakers, 2006; de Vries, 2005; Fox- Turnbull & Sullivan, 2013; Hoyle, 2008)

Teachers' ways of thinking about both technology and technology education are likely to connect to their lived experiences but will also be mediated by the socio-cultural (centre or school) context. Technical ways of thinking are aligned more closely to a traditional view of the subject, whilst a technological way of thinking more explicitly acknowledges the role of problem-solving, creativity, and critical approaches to learning (Reinsfield & Williams, 2017). Both concepts have a role to play in

enacting technology education, from a range of different perspectives, but equally, an emphasis on either can moderate students' learning in the subject. For example, if a teachers' sole emphasis is on creativity during the design and development phases of students' technological outcomes, it might be that the quality of the outcome or students' evolving understanding of the manipulation of materials is detrimentally impacted. Conversely, if the focus is on skill development, the quality of the product may be assured at the expense of creativity or innovation. As a result, professional learning needs to be designed so that it acknowledges its participants' world views of technology education and related pedagogical practices. The next section describes the design of this research project.

Project design

The research project was situated within an interpretivist framework (Reeves & Hedberg, 2003). A socio-cultural lens accommodated a deliberate focus on teachers' evolving understandings. Data was collected from an initial meeting with Mātanga, evidence from Mātanga and participants' engagement with the online PLD (over ten months), and targeted interviews with six participants at the end of the project. These participants were deemed to have modelled "best practice" by both researchers, who are teacher educators in technology education, and have facilitated professional learning and development over decades, in both the United Kingdom and New Zealand.

Data analysis was based on weekly face-to-face and online interactions over six months (as evidenced predominantly through discussion forum) between project facilitators, Mātanga (n=9), and teachers (n=12) in the Early Childhood, Primary and Secondary sectors of education. Mātanga and teachers' (pseudonyms) groupings are outlined in Table 1. These groupings were determined by sectors and/or technological areas of interest.

Table 1. Mātanga and teacher groupings

Mātanga	Sector/Interest	Teachers	Sector/Interest	Teachers	Sector/Interest
Beth	Secondary: Materials	*Karen*	Secondary: Design and digital		
Colette	Early Childhood	*Helen*	Early Childhood		
Graham	Secondary: Materials	*Derek*	Secondary	*Julie*	Secondary
Jenna	Intermediate: Processing	*Kayla*	Primary: Integration		
Joanne	Primary: Materials and electronics	*Amy*	Secondary: Materials	*Charlotte*	Secondary: Materials
Kylie	Secondary: Materials	*Rebecca*	Secondary: Materials		
Kevin	Secondary: Design	*Abigail*	Secondary	*Adam*	Secondary
Susan	Primary, Intermediate, Primary	*Reggie*	Primary		
Willow	Primary and Tertiary	*Natalie*	Primary		

Thematic analysis was used for the extraction of meaning and reporting of emerging knowledge (Javadi & Zarea, 2016) and was guided by the research questions, and existing literature on contemporary approaches to professional learning and development in technology education (e.g., Akiba & Wilkinson, 2015; Aminudin, 2012; Reinsfield, 2018). The research questions of focus here, included

1. How did the Mātanga project foster technology teachers' understanding of the technology curriculum?
2. From the Mātanga' perspective, how did the project develop communities of expertise, a self-sustaining model of professional learning and development, and participants' connection to their subject's identity?

This research design was deliberately chosen to determine how each teacher navigated the complexities that influenced their engagement with the PLD when using alternative pedagogies in a deliberate and informed manner, and to reflect upon their pedagogical practice (Lampert, 2010; Soslau, 2012). A key outcome was the establishment of new knowledge about the ways that technology teachers can be supported to develop their practice, because of the paucity of research in this context of technology education, in New Zealand.

Findings and discussion

The Mātanga identified various factors affecting the nature of technology education in New Zealand, which in turn determined the way that they sought to foster their teachers' understanding of the technology curriculum. Most evident were the tensions for teachers' curriculum and assessment understandings and the pressures being placed on practitioners to remain current in their practice, whilst also responding to the curriculum changes in future-focused ways (Biggs, 2006; Dakers, 2006; de Vries, 2005; Fox- Turnbull & Sullivan, 2013; Hoyle, 2008; Gilbert, 2007; Lewis, et al., 1998; Reinsfield, 2018; Williams, 2015). There were differing understandings and interpretations of the technology curriculum by Mātanga, as the result of their professional experiences. Most pertinent for them, was the need to embrace the new Digital Technologies aspect of the revised technology curriculum, in terms of learning about notions of computational thinking and designing and developing digital outcomes. They perceived that the nature of the subject was changing, leading to a need to review their students' learning programmes in an informed, responsive and deliberate manner. These priorities translated into professional learning discussions. Susan, an experienced technology teacher and specialist team leader, who was leading the implementation of the new Digital Technology aspect of the curriculum, stated

> …for me personally, I think I had quite a good understanding of technology in comparison to the people we're trying to help. I think I'm quite solid, but it's still quite good to listen to other people and see how other people do things, too. I think that's been quite beneficial for me.
>
> … And also seeing the different backgrounds that people come from, having the chance to discuss with other technology teachers who, for example, are quite traditional in their approach to technology and very practical hands-on and struggling to see how you can actually incorporate the whole nature of the curriculum. So you'd include the nature of technology into something. That's been quite an eye opener…
>
> …obviously with a focus that's coming up with digital technology, I think they originally just thought about incorporating digital technology in their classroom because they were primary based teachers… I'm actually hoping that [the] awareness translates across the other [curriculum] areas as well.

There appeared to be a tension for Susan, who implied a persisting challenge for "traditional" teachers to change their thinking about the contemporary nature of technology education. She implied that in the Primary context, there was a view that using digital tools (for teaching) might be perceived as addressing the digital content in the technology curriculum. Such an approach instead presents a risk that students' computational thinking or opportunity to design and develop digital outcomes are likely to be marginalised.

The need for technology teachers to change their understanding of ways to address the digital technology aspect of the curriculum content was a persisting theme from Mātanga, who acknowledged that teachers would have to feel professionally supported during this transition period for technology education and

when setting their goals, saw opportunities to collaborate, assist, and mentor colleagues. Mātanga hoped that by engaging in the project, they too would gain support for their own professional development, particularly in the areas of professional mentoring, culturally responsive, evidence-based and innovative practices. When reflecting about the effectiveness of the project, Mātanga focused on the perceived issues in technology education, and how their own understandings and skills had impacted their facilitation.

Perceived issues in technology education

The diverse and sometimes conflicting nature of teachers' understanding of the technology curriculum was raised as an issue by the Mātanga, because of its recent revision. The need to reposition the subject as being future-focused was highlighted by Bruce in his application for the project. Bruce was a teacher of Year five and six students with expertise in Digital Technology. He stated that he wanted to be involved in the project

> … to improve my understanding of the New Zealand Technology Curriculum leading to enhanced learning for students. I would like to lead learning across the school to improve technology education. I believe we could be doing better developing technological understandings in our students and given the world now, and the future world, they will go into, it is important to upskill ourselves as educators to do this.

When reflecting about the project's effectiveness during his final interview, he stated that the project had also impacted his leadership skills, stating

> I definitely think the mentoring model is the way to go to sustain over a period of time - like a year or even longer. So often in schools, you have a bit of PD. You are expected to make a change, change practice, then you're on to something else.
>
> So I think the model of Mātanga, [where]we are here to support [teachers] for a whole year… for a year of learning or even longer. We are mentors. So we are not doing the work of just transmitting a whole lot of knowledge. That actually is a really successful way of doing it. It is mentoring and coaching as opposed to going to a course. It made me think about the effect on my own leadership.

Bruce suggested a lack of professional learning and development that aligned curriculum knowledge with mentorship, which is particularly pertinent during this time of sustained change in New Zealand education. Kylie also suggested various issues affecting technology teachers during this period of change, and mirrored the potential for collaboration in and across schools. She indicated a need for

> … more cross-pollination and a breaking down of "silo's" within technology departments as well as across subjects. This requires support for teachers to feel confident to step outside their comfort zones and try new ideas…
>
> Also, helping teachers develop authentic contexts for students, such as re-developing the school grounds, revamping a classroom, [or] garments for road safety would be helpful. Often in a school a teacher can be the only specialist teacher and may not have colleagues that share their thinking, which makes for a lonely existence and a lot of work developing resources in isolation. Some way of deepening collaboration and sharing in and across schools could provide support and encouragement for those that feel alone and security for others to try new approaches to their practice.

The recent revision to the technology curriculum has highlighted the need to continue to view technology education from an holistic rather than siloed perspective - particularly in the ECE, Primary and Junior Secondary sectors. In such a context, teachers will be required to consider the evolving nature of technology and its relationship with societal needs. Reinsfield's (2018) research indicated that when teachers primarily identified as a specialist teacher (of hard materials, for example) rather than a teacher of technology education, they experienced more difficulty when making connections between their specialist understanding, professional experiences, and the technological concepts in the curriculum (MoE, 2007, 2017a). Specialist knowledge (of carpentry, for example) does not necessarily equate to an

ability to interpret the technological concepts in the curriculum, or to think in technological ways, to enable teacher's practice (de Vries, 2005; Fox-Turnbull & Sullivan, 2013; Reinsfield, 2018).

Mātanga understandings and skills

Appropriately, the Mātanga conceived the nature of technology education as a result of their professional experience and engagement with the technology curriculum in their context. Curriculum understandings were espoused differently, and appeared determined by the sector within which the practitioner worked. Colette, an Early Childhood Education (ECE) centre manager, described technology education as being enacted through technology-use in her context, and stated

> My leadership experience has enabled me to work alongside teams with varying experiences of technology and support teachers to learn and develop their understanding of ways to use technology for fostering a culture of learning and knowledge, underpinning everything they do through Te Whāriki [New Zealand ECE] curriculum document…
>
> In my work as a Kindergarten teacher I consistently maintain an attitude of open mindedness to learning. This attitude endorses my work *through* technology and positive persistence when working with colleagues, coaching them through the constantly evolving nature of technology in education today. [Emphasis added]

Using digital technology as a tool to enable learning is a technical way of thinking about technology education because it only considers the use of technologies rather than the more holistic view, as outlined in Te Whāriki. Technology education is defined in Te Whāriki as a way for "Students [to] learn to be innovative developers of products and systems and discerning consumers who will make a difference in the world" (MoE, 2017c, p. 57). It is interesting to note that it is not common practice for ECE students to have courses related to specific learning areas such as technology, therefore there is a risk with the recent changes to the curriculum in New Zealand, that technology education in ECE will privilege learning about the use of digital technologies.

Poppy, a secondary school food and textiles teacher, also described a technical way of thinking about technology education. Her explanations were associated with a product and/or process-driven approach when she stated

> My understanding of technology [entails the] development of a prototype, using the technology design process... Using skills, knowledge and techniques to address needs… Developing a healthy cupcake was a challenging experience but was successful in terms of how students justified their trials and developed their recipes to make a cupcake with fruit in the batter.

This technical approach to technology education is pervasive in the subject, particularly in the senior secondary school context, where students engage with projects that can last up to three terms in duration. In New Zealand the Ministry of Education is currently revising its senior secondary qualification certificate, the National Certificate of Educational Achievement (NCEA) (New Zealand Qualifications Authority, 2019). The reconceptualisation of assessment practices may embed, consolidate, or challenge practitioners' future thinking about pedagogy (e.g., Boyatzis et al., 2002; Fullan, 2002; Grundy & Robison, 2004; Handal & Herrington, 2003).

Kylie perceived technology education differently to Colette and Poppy. As a secondary teacher of e-textiles and electronics, Kylie explained the types of projects she developed. These descriptions signalled both technical and technological approaches to thinking, as well as a negotiated approach to student learning. When applying to become a Mātanga, she indicated that

> This semester students are still deciding whether the final outcome will be a community project or a range of smaller projects - e.g., each individual textile is developed into a quilt perhaps or knee blankets for the local rest home…

> Senior projects are generally based around a minor project in Term 1 - with a focus on assessing skills although using a brief and following a technological process to scaffold for the major project, which usually assesses prototype and applied design/pattern adaptation/influential designer/design era depending on the nature of the students' project, personal interests and strengths.

During the final interview, Kylie reflected that the project facilitated

> … those opportunities to meet up, with like minded people or people that are on the journey that want to move forward. I'd say the subject identity is probably more of an issue from people outside the subject and people in senior leadership in some cases, rather than within the subject. However, I guess our tradition, you're making wooden spoon characters, it's going to take a lot to shift them...
>
> I would like to think that people that enrolled on the project as Mātanga, if they're more traditional that they started to see a shift in the deeper understanding of what the subject's about… [Some] people still think it's just coming in to do some skills and that's that without any of that higher order critical thinking.

The findings indicate that teachers' perceived issues and understandings of the technology curriculum motivated what they wanted to contribute to the Mātanga project, and influenced their interpretation and facilitation of the given tasks. The need to support Mātanga' developing mentoring skills was a pervasive finding, and perceived as a barrier to both their facilitation and the consolidation of a self-sustaining model of professional learning in the community. Interestingly, those Mātanga with skills in the use of digital technology, experience or intuition in terms of leadership, were in a privileged position to engage with the online forum for professional learning and development. Findings from this research project will be used to inform the next phase of the Mātanga project, where Mātanga become ambassadors, and teacher participants become Mātanga. Such a networked model presents opportunities to further develop a self-sustaining approach to professional learning and development, which should acknowledge the connection between the need for mentorship when adult learners are reflecting upon and potentially re-thinking about their subject identity (Morrison & Ferrier-Kerr, 2015).

Conclusion

The Mātanga project was designed to address an identified need to consolidate technology teachers' understanding of the curriculum in New Zealand on a needs basis. The online model encouraged engagement from those participants' across the country, who could be supported by experts in their sector of education. The findings indicated clear connections between the issues in technology education in New Zealand, and a need to continue to support the community's evolving curriculum understandings. Those participants who engaged most were confident users of digital technology, but most significantly, success was observed where Mātanga utilised these when demonstrating an intuition for, or experience in, curriculum leadership. Future PLD curriculum models of this nature should consider the identification of curriculum leaders who have or are prepared to develop their skills in mentorship.

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Elizabeth (Liz) Reinsfield is the Director of Undergraduate and Graduate Programmes in Te Kura Toi Tangata School of Education at the University of Waikato, New Zealand. Liz's research interests include teachers' engagement with and enactment of the curriculum, cross-generational perceptions of innovation, and the nature of programme design and development in Initial Teacher Education. In 2019, Liz led the Mātanga project - a national professional learning programme (PLP) for Early Childhood, Primary and Secondary technology teachers in New Zealand to engage with, make-meaning of, and enact the curriculum. This was particularly pertinent because of the recent curriculum revision, and consequent emphasis on Digital Technology. As a result of this work, she was given the Technology Education New Zealand (TENZ) Award: Outstanding Teacher Educator in Technology. In 2020, Liz also received the TEFANZ Emerging Researcher in Teacher Education Award.

Wendy Fox-Turnbull is an Associate Professor at the University of Waikato who is Deputy Head of School for Te Kura Toi Tangata- School of Education. Wendy was chair of the Technology Education New Zealand (TENZ Council) from 2006 to 2018, and has convened two TENZ conferences: TENZ 2005 and TENZ/ICTE2017 and one International Technology Research conference (PATT) in 2013. She previously taught at the University of Canterbury's College of Education, in Technology Education, primary and secondary, Professional Inquiry Studies and Inquiry Learning from 1997-2017. Research special interests include authentic learning in technology education, the place of women in technology related careers, the role and nature of effective conversations in learning and teaching and learning approaches for the 21st Century. Wendy has presented regularly at PATT and other international conferences and published in a range of journals and books in the field of technology education. Wendy is a registered and certified primary teacher.