CHAPTER 23

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# Talking Technology into The Future

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**Abstract**

From its very inception in the 1980s Professor Marc de Vries has been a
strong advocate for and supportive of the Technology Education in the
New Zealand curriculum, its philosophical underpinning and pedagogical
approaches. This support has always been very much appreciated by the
technology education community in New Zealand. In addition Marc's
support has given the curriculum 'mana' [prestige] both within New
Zealand and internationally. Like many countries around the world New
Zealand has had its challenges in implementing and maintaining
technology as part of the taught curriculum. There has been and is
currently a reluctance to see and understand that serious and rigourous
curriculum can be both academic and practical in nature. This duality is
both a strength and a threat to technology. This chapter presents the
authors's SWOT [Strengths, Weaknesses, Opportunities and Threats]
analysis of technology in New Zealand, taking into consideration the past
while walking with head held high into the future drawing on her
experiences as a teacher, teacher educator, researcher and curriculum
developer in technology education from 1996 to the current day.

**Introduction**

*Kia whakatōmuri te haere whakamua.*
*I walk backwards into the future with my eyes fixed on my past.*

Technology first appeared as a part of the New Zealand curriculum when it was included in The New Zealand Curriculum Framework (Ministry of Education, 1993a) as one of seven essential learning areas (Jones, 2006). That same year the draft technology curriculum was published (Ministry of Education, 1993b) and trialled through 1994. After significant consultation with relevant sectors, Technology in the New Zealand Curriculum (Ministry of Education, 1995) was published for the first time in 1995. Learning was organised into eight levels of achievement from Years 1-13 and incorporated three strands: Technological Capability, Technological Knowledge, and Technology and Society.

Full implementation occurred in February 1999, when technology became part of the compulsory curriculum for students in years 1-10 (5–14-year-olds). In 2001, a curriculum stocktake was undertaken to review current curricula, teachers' experiences with it, and international trends. This resulted in the development of a revised and refined curriculum. The launch of the New Zealand Curriculum (NZC) (Ministry of Education, 2007) saw significant changes in technology and included the introduction of two new strands (Ministry of Education, 1995, 2007) and the modification of one. The new strands became Technological Practice, Technological Knowledge and Nature of Technology (Ministry of Education, 2007). When the 1995 technology curriculum was written, it had never been taught in schools, however before the development of the 2007 technology learning area considerable research was undertaken lead by Dr Vicki Compton. In 2007, technology was redefined as "intervention by design, the use of practical and intellectual resources to develop products and systems [technological outcomes]" (Ministry of Education, 2007, p. 32). The new strands allowed for the considered and efficient development of culturally and environmentally situated technological practice and outcomes. The general aim of technology education in NZC is to develop technological literacy through understanding across all three strands (Ministry of Education, 2007, p. 32). NZC (Ministry of Education, 2007) also suggests technological literacy enables students to develop a broader, deeper, and more critical understanding of technology (Compton & Harwood, 2007). The 2007 technology curriculum incorporated five technological areas: biotechnology, control, food technology, information and communication technology, and structural technology (Ministry of Education, 2007) and identified the concepts of the transformation, manipulation, storage, transportation, or control of either materials, energy, or information (Compton & France, 2006).

The New Zealand Minister of Education announced in July 2016 that digital technologies needed to become more explicit in the New Zealand

curriculum (Ministry of Education, 2017a; Stuff, 2016). Because the aim of digital technologies is to design and development of digital technologies it was situated within the technology curriculum (Ministry of Education, 2017b) to ensure learning is built on an holistic constructivist model of learning (Fox-Turnbull, 2017). A revised version of Technology in the New Zealand Curriculum was published in 2017 (Ministry of Education, 2017b). The extended *Digital Technologies* covered aspects of computer science, programming and computational thinking (Bell et al., 2016). The technological areas were redeveloped as outlined in Figure 1 and included:

– Designing and developing materials outcomes
– Designing and developing processed outcomes
– Design and visual communication
– Computational thinking for digital technologies
– Designing and developing digital outcomes.

Figure 1: The 2017 Revised New Zealand Technology Curriculum
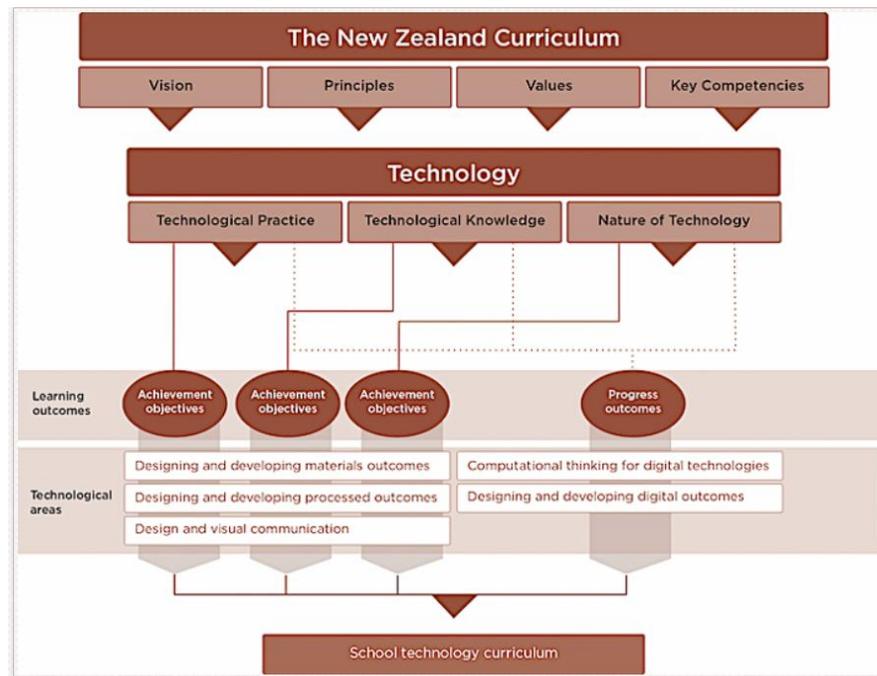


(Ministry of Education, 2017b)

The goal of this change was to ensure students learned about digital technologies, designed and developed digital technologies, and to understand the decisions people made when they create and use them.

### SWOT Analysis of Technology Education in the New Zealand Context.

Technology is New Zealand is internationally well regarded; however, it is not perfect. This section identifies and discusses three to four strengths and weaknesses of technology in The New Zealand national curriculum. In addition it also discusses three to four potential threats to and the opportunities for current curriculum and the refreshed New Zealand Curriculum Te Mataiaho currently under development.

### Strengths

The key strengths identifed and discussed in this section include the opportunity for authentic learning giving students a sense of empowerment, engagement in 21$^{st}$ Century future-focused skills, knowledge and competencies, opportunities for students to deploy their funds of knowledge in a meaning context and implementation of digital technologies and developing students to be problem solvers and critical thinkers who collaborate and celebrate failure.

As students progress through their technology education journey in schools their skill development, abstract and critical thinking develops. Studying technology through to the end of secondary school presents students with opportunities to design and develop technologies that can make a real difference in the lives of others, thus enabling a sense of empowerment and voice. This was illustrated number of years ago when a colleague teaching Design and Visual Communication (DVC) shared her student's work with me. The student had designed and developed a New Zealand version of 'Life of a Cow' for her senior secondary assessment. Although the message is not one I totally agree with I was impressed with the sense of empowerment the process of designing and developing such as outcome must have facilitated. In technology our young people have opportunities to intervene in the made world in meaningful ways.

A goal of the New Zealand education system is to have students experience a rich curriculum that engages and challenges them, is forward-looking, and is inclusive (Ministry of Education, 2007). The 21st

century has changed the type of skills, knowledge, and competencies that are needed for success in the modern society. Learning through the solving of problems by designing and developing potential solutions in technology offers students authentic opportunities to develop skills and competencies as they are needed. This approach is both engaging and motivating as students understand the role their learning plays in their current lives and facilitates link-making to their own and others' futures.

Another strength of technology education in New Zealand is that it offers opportunities to use their cultural funds of knowledge (FOK). Funds of Knowledge describe the developed bodies of knowledge and skills that are accumulated by a group, for example, a family or the individuals within, to ensure that they can function appropriately within their social and community contexts (Lopez, 2010). In New Zealand Māori and Pacifica people are underrepresented in STEM related careers. One way to challenge and disrupt this is to highlight the strengths and resources of Māori and Pacifica communities through a focus their funds of knowledge (Hunter, 2021). In addition, students who are considered by their peers and themselves to be 'less academic' have opportunities to excel in technology as they bring to technology their practical funds of knowledge and problem-solving stills from their extended family thus providing opportunities to develop mana (prestige) and to be seen by their peers in a different light.

Recent additions to the current technology curriculum in New Zealand are the introduction of the technological areas Designing and Developing Digital Outcomes and Computation Thinking for Digital Technologies (Ministry of Education, 2017c), which enable students to know how to use and create digital technologies. Computer science concepts and thinking computationally are being recognized as important for everyone (Bell et al., 2014). Aspects of computation thinking are easily integrated across the curriculum. In recent research project a colleague was teaching year 4-6 students to write and debug a small programme on an App developed by the research team. One of the boys indicated that the debugging activity was cool and likened the process to editing a story. He thought 'debugging' his story was 'way cooler' than editing it. In the same research project students learned sequencing, pattern recognition, abstraction, and decomposition and debugging as aspects of computational thinking. All skills applicable to both literacy and numeracy thinking.

The final strength that I would like to discuss is that technology education requires students to become collaborative problem solvers and critical thinkers. Undertaking successful technology practice requires collaboration with peers and others, when working in groups success

requires seeing ideas from a variety of lenses, compromising, and celebrating their own and others' failures as much as the successes. Failures and mistakes require evaluation, reflection, critical thinking, further investigation and having another informed go. Students who may not experience much success with written work can and do succeed in technology.

### Weaknesses

In this section I outline the key weaknesses of Technology Education as it is currently situated in New Zealand. These weaknesses inform the subsequent threats and opportunities sections below. Key weaknesses identified include a lack of New Zealand trained technology teachers, the training of technology teachers as well as aspects of our senior secondary school assessment practices.

New Zealand currently has a considerable lack technology teachers. "The Education Gazette | Tukutuku Kōrero is produced by the Ministry of Education for teachers, leaders and other education professionals working in New Zealand. It's the place to advertise job vacancies, notices and announcements, and to read articles that explore and celebrate the education system" (Ministry of Education, 2024). At the time of writing, I undertook a search for technology vacancies in the Aotearoa New Zealand Education Gazette Tukutuku Kōrero three weeks after the beginning of the academic year on 21 February 2024 when one would expect that vacancies would be at their lowest. The search identifed 24 vacancies for technology teachers across all the technological areas. To put this in context in 2023 there were 374 secondary schools in New Zealand (https://www.educationcounts.govt.nz/statistics/number-of-schools). The inability of schools to find technology teachers has several potential implications. If teachers are unavailable schools may cease to offer the subject, non-qualified or 'out-of-field' teachers may be asked to fill the gaps or the vacancy may be filled by foreign teachers whose training and underpinning understanding and teaching philosophy is likely to be different to what is practiced in New Zealand.

Having said that there are several challenges associated with the education of technology teachers in New Zealand. Secondary teacher education in New Zealand required at least a bachelor's degree in their field of teaching. Students subsequently undertake a graduate diploma or post-graduate diploma in teaching to gain provisional certification to teach in New Zealand. Graduate diploma or post-graduate diploma

courses typically run over the calendar year. At the University of Waikato for example, the programme starts mid-January and finishes towards the end of November. The programme is very intense and condensed. To succeed students, need to be very disciplined and time-smart- qualities also required of teachers, however the challenge is that most student teachers also need to undertake part-time work in order to survive. Many in the initial teacher education sector would like to see this programme expanded to at least 18 months or even two years. This would ease the pressure on students and universities and enable students the time to think, reflect, critique, and evaluate their learning and future practice as a teacher.

Another issue associated with the education of secondary technology teachers is the need for a bachelor's degree in their teaching subject. In the past some of the technological areas have not drawn from people who have degrees. Technology requires and values practical as well as academic skills and knowledge. People from trades and non-degreed fields, who are skilful and experienced have difficulty finding a pathway into technology teaching. Several universities have worked on programmes to mitigate this by facilitating either recognition of prior learning or develop alternative pathways into the profession. For these students working in an academic programme can throw up challenges and some struggle to complete the programme unless they are very well supported by their universities.

Most students in New Zealand undertake their National Certificate of Educational Achievement (NCEA) at three levels in their final three years of secondary schools. NCEA Level 1 in Year 11, Level 2 in Year 12 and L3 in Year 13. The qualification is recognised by employers and universities and other tertiary education providers and is managed and maintained by the New Zealand Qualifications Authority (NZQA) (New Zealand Qualifications Authority, 2024). Each year students and teachers select and submit evidence to meet a range of externally and internally assessed achievement standards (AS). In theory this could be a wonderful opportunity for students to undertake their technology practice and evidence their process, learning and understanding within a technology portfolio and subsequently select appropriate AS as best evidence of their learning. However, the reality is much more complex. NZQA requires schools and teachers to register the AS they are using for assessment throughout the school year in the first term of the year. This of course, is understandable, as NZQA need to prepare examinations and summative assessments as well as ensuring rigourous moderation practices are

undertaken, however it does decrease the flexibility for teachers and students to respond to students' individual learning needs and practices.

Another weakness of the NCEA system occurs when students who want to specialise in more than one technological area. For example, a student who undertakes DVC may also want to study resistant materials or textiles. However each AS can only be assessed once, which means students are limited in the selection of AS for assessment depending on what standards are assessed in their other technological area. Unfortunately this has led to a movement away from generic technology practice, skills and knowledge standards to more specific and fragmented standards in each of the technological areas.

The final weakness of the NCEA systems that I believe is worth mentioning is assessment driven practice. I wish I had a dollar for every time I have heard a technology teacher stay "I am teaching AS *xy* standard this term". In my view teachers should not be teaching achievement standards. They should be teaching the curriculum through carefully designed programmes of work that involves students developing their understanding of technology and undertaking technology practice. The AS can then be used to assess students' work against the standards at levels: not achieved, achieved, merit or excellence.

### Opportunities

In this section I discuss the one most exciting opportunity for technology education in New Zealand at the present time. That is the Te Mātaiaho/Curriculum Refresh project with the technology refresh currently underway. The Ministry of Education website states

Te Mātaiaho | the refreshed NZ curriculum is designed to give practical effect to Te Tiriti o Waitangi and be inclusive, clear, and easy to use. It has been developed over the last three years in collaboration with the education sector, students, whānau, communities, and a wide range of interested organisations and communities. The updated draft of Te Mātaiaho was released in Term 4, 2023, and included the three refreshed learning areas released so far: te ao tangata | social sciences, English, and mathematics and statistics. The other five learning areas are still being refreshed and will be released in 2024 and 2025. Schools and kura have until 2027 to begin using the complete refreshed curriculum (The Ministry of Education, 2024).

Te Tiriti o Waitangi is New Zealand's founding document between Māori and the British Crown and was signed in 1840. Amongst other

things the main purpose of the treaty was to protect the Māori from European lawlessness and as Māori believed to protect their land, language and tikanga (cultural treasures), however in reality for many years the treaty was not honoured, with Māori losing their language and much of their land. The New Zealand education act of 2020 stated that education in New Zealand should honour Te Tiriti and support Māori-Crown partnerships (Parlimentary Counsel Office, 2024). At the end of 2022 I was appointed one of two 'subject matter experts' (SME) in technology as a part of the refresh process by the New Zealand Deans of Education. I was the only SME in English medium; the other was in Hangarau (Māori medium technology). With a wide team of practitioners and MOE advisors the draft Technology curriculum was developed in 2023 and was due for release in October that year, however due to a change in government this release is yet to occur. Although I am unable to share the proposed changes in technology at this time, I can say that I am excited by the opportunities the direction of the refresh may bring. The proposed curriculum is centres on Te Ao Māori (Māori world view). The released learning areas and the whakapapa (genealogy) of the new curriculum framework celebrate Māori ways of seeing the world and learning. Learning is holistic. In technology this could mean that generic technology practice is centred around people, practice, and place. In a Māori world view the environment is a living being which is as highly valued as people. This holistic approach will identify Māori as New Zealand's first technologists, it will place high value on the environment, considering both short- and long-term impacts of technological development and how and why materials and information are used. This will mean that students will learn that technology practice is not isolated from our environment and people but an integrated piece of it, hopefully leading to a better world for all.

Another exciting opportunity to evolve recently in New Zealand technology is the increased visibility and developed understanding of designing and developing digital technologies. The technological areas Designing and Developing Digital Outcomes (DDDO) and Computational Thinking (CT) in the 2017 version of the technology curriculum has heightened awareness of the digital realm but also made explicit what and who young people to learning and do to position themselves as innovative designers and creators of digital solutions and moving beyond solely being users and consumers of digital technologies. This combined with the new approach of te Māitaiaho offers opportunities for students to critically assess the impact of existing and new technologies on society

and the environment as well as design for a future safe and inclusive world.


**Threats**

The key threats to the future of technology education in New Zealand I have identifed include a lack of understanding and status of technology, teacher history background and teaching approach, lobby groups pushing their own interests at the expense of the integrity of the discipline, change of government, and teacher professional learning and development (PLD).

For many years technology as suffered from a continued lack of status within the school system and its often misunderstood dual academic/ practical nature of the discipline by senior school management, principals, parents, and politicians. The implications of this include less time allocated for technology in a school timetable, students either pushed into technology (because they are 'not academic') or turned away from or discouraged to take technology (because they are too academic) as a school subject even though technology significantlu contributes to understanding and practice in a range of professions such as engineering and architecture.

Another threat is the power of lobby groups to influence curriculum decision making to ensure their own interests are met, while not necessarily understanding the wider implications for students or specific learning areas. This was clearly illustrated in New Zealand with the strengthening of digital technologies. Originally the New Zealand Computer Society called for digital technologies to be a learning area within the New Zealand curriculum, rather than be situated with technology. This issue is partly related to the one above, as those from the New Zealand Computer Society did not have a thorough understanding of technology, in fact their assertions were based on outdated practice. Another digital technologies issue also related to the lack of understanding of the technology curriculum were the plethora of organisations that applied to the MOE to deliver professional learning to teachers in digital technologies. I witnessed several examples where digital technologies professional development involved teachers and children engaging in series of skills-based fun activities related to coding, and programming with few links to the technology curriculum or authentic technology practice. The implications for this include students not able to see the relevance of what they are learning and a lack of

connections to their current or future lives, thus they lose motivation and become turned off technology.

The final threat I would like to identify comes in the form of teacher PLD in relation to the implementation of the Māitaiaho / Refreshed curriculum in New Zealand. The proposed curriculum has the potential to facilitate huge shifts in education towards a more inclusive and equitable curriculum for all New Zealanders. At the point of writing there is no certainty that the proposed shift will occur, however if it does New Zealand is well positioned to become world leading in positioning our indigenous thinking, knowledges, and skills within a national curriculum. However, this giant shift in thinking and practice can only occur with very significant support for consistent PLD of high quality for teachers provided by the Ministry of Education. Given the current government's current fiscal rhetoric about our vulnerable financial position this seems unlikely. Implications of insufficient support for teacher PLD include, failure of the curriculum, incomplete shifts in practice and a very confused teaching body, not to mention the students in their classrooms.

### Conclusion

Technology Education in New Zealand is currently sitting on precipice, however threats to its future are not insurmountable. I conclude this chapter feeling excited for the release of the draft refreshed technology curriculum. Given the hundreds of people-hours of work that has gone into the development of the draft refreshed curriculum I find it hard to believe that any responsible government would drop such a world-leading curriculum. Once released in total much of the required shift will have to occur at a whole school level and will be the responsibility of school's senior management to ensure it is implemented fully with the support (hopefully significant) of the Ministry of Education. Time and time again I have seen the empowering nature of technology on students. It is well situated to deliver an education within which our students become critical thinking reflective technologists who understand the world they live in and know how to care for it. "Space junk and pollution begone!!"

### References

Bell, T., Duncan, C., & Atlas, J. (2016). Teacher feedback on delivering computational thinking in primary school. Proceedings of the 11th Workshop in Primary and Secondary Computing Education,

Fox-Turnbull, W. (2017). *TENZ Response to Digital Curriculum*.

Hunter, J. (2021). Disrupting deficit discourses in mathematics education: Documenting the funds of knowledge of young diverse learners. *Excellence in Mathematics Education: Foundations & Pathways*, 431.

Lopez, J. K. (2010). Funds of Knowlege. *Learn NC*. Retrieved 9 March 2010, from www.learnnc.org

Ministry of Education. (2007). *The New Zealand curriculum*. Learning Media.

Ministry of Education. (2017a). *Digital technologies-Hangarau matihiki, draft for consultation*. Ministry of Education https://education.govt.nz/assets/Documents/Ministry/consultations/DT-consultation/DTCP1701-Digital-Technologies-Hangarau-Matihiko-ENG.pdf

Ministry of Education. (2017b). *Digital Technologies and the national curriculum – what's it all about?* Retrieved 5 December 2017 from http://elearning.tki.org.nz/Teaching/Curriculum-areas/Digital-Technologies-in-the-curriculum

Ministry of Education. (2017c). *Strengthening digital technologies hangarau matihiko in the curriculum*. Retrieved 3 November from https://www.education.govt.nz/ministry-of-education/consultations-and-reviews/digital-technology-consultation/

Ministry of Education. (2024). *The Education Gazette | Tukutuku Kōrero* Retrieved 20 February from https://gazette.education.govt.nz/about-this-site/

New Zealand Qualifications Authority. (2024). *New Zealand Qualifications Authority (NZQA)* Retrieved 20 February from https://www2.nzqa.govt.nz/

Parlimentary Counsel Office. (2024). *New Zealand legislation: Education and training act 2020*. Retrieved 21 February from https://www.legislation.govt.nz/act/public/2020/0038/latest/LMS170680.html?search=sw_096be8ed81df65ae_Te+Tiriti+o+Waitangi_25_se&p=1&sr=2

Stuff. (2016). Digital Technologies coming to NZ curriulum. (7 July 2016). http://www.stuff.co.nz/national/education/81763452/Digital-technology-coming-to-the-NZ-Curriculum

The Ministry of Education. (2024). *Te Mātaiaho | the refreshed NZ curriculum*. Ministry of Education. Retrieved 20 February from https://curriculumrefresh.education.govt.nz/te-mataiaho