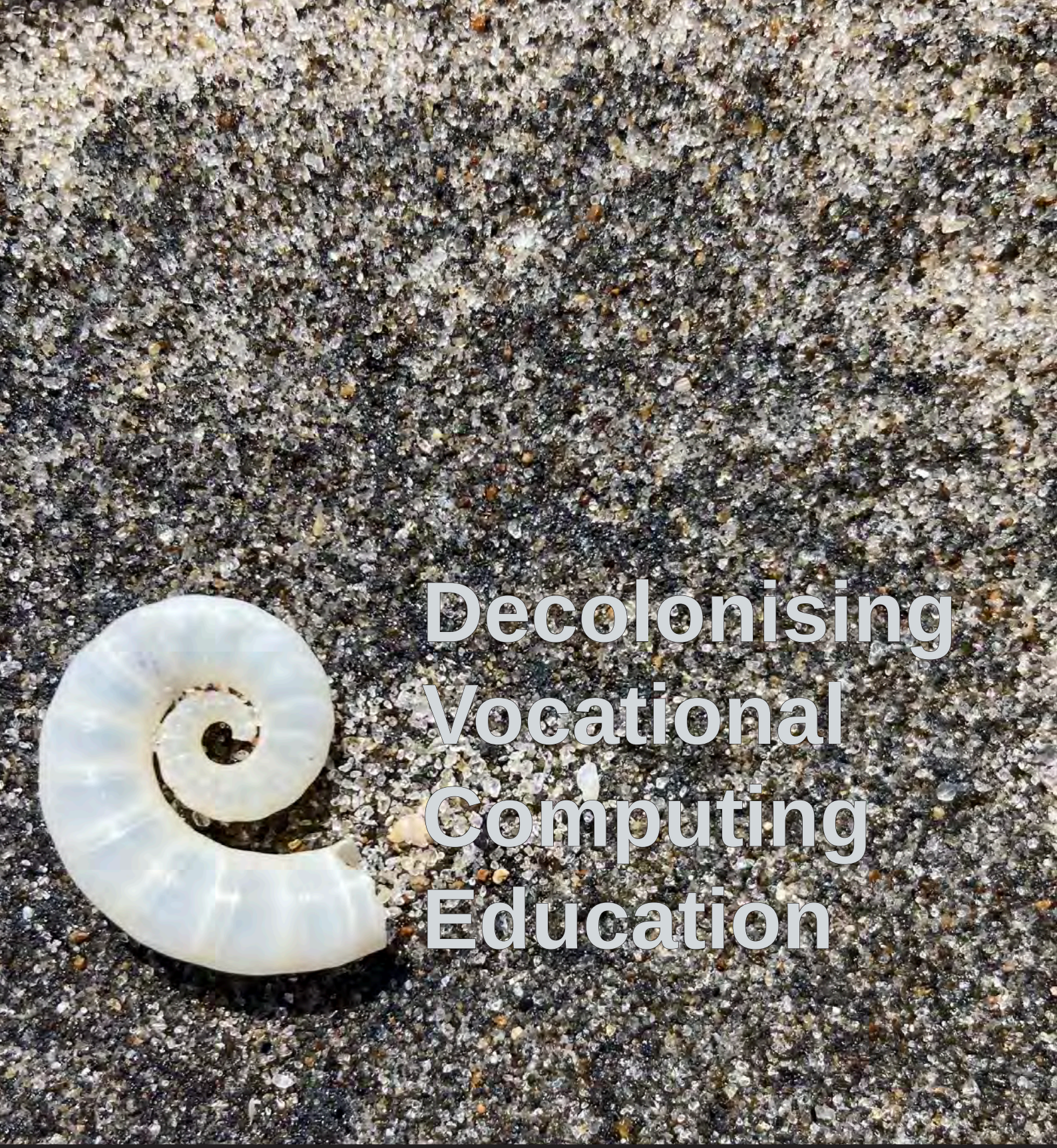

Decolonising Vocational Computing Education

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Abstract

There is an increasing recognition that computing education and the profession of computing has failed Māori. In order to consider reforming vocational education's computing programmes so that they address the needs of Māori learners, we must first consider the role of computing as a negative colonising force that continues to the present. This paper uses pūrākau to provide context for a reframing of computing as a decolonising force. The development of the school curricula is considered as an example of the outcome of development in te Tiriti honouring partnerships. We then canvas some potential directions a transformation of vocational IT education might take. This paper is not intended to replace or pre-empt partnerships or by-Māori-for-Māori, but to nudge development towards an approach that honours te Tiriti and improves outcomes for all learners.

Decolonising Vocational Computing Education

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Nā tō rourou, nā taku rourou ka ora te iwi

With your contribution and my contribution our people will prosper

Mawera (Kai Tahu, Kāti Māmoe, Waitaha) has come to academia through a life of service to people and community. Mawera uses pūrākau (story telling) as an indigenous ethnographic method for recording and protecting lived experience and knowledge. Her doctorate work explored identity activism, social justice in communities, and ways of measuring impact. Mawera has lectured in IT, business development and also operated a successful IT company that specialised in data management.

Sam was raised in Cornwall before arriving in NZ age 12 with teacher Mum and actor/nurse Dad. He studied geography before stumbling into teaching interaction design and sustainable practice. With Emeritus Professor Khyla Russell, he co-led the Simpā project which aimed to provide pathways for rangatahi that integrated computing and mātauraka Māori. He helped lead the previous review of computing qualifications and is aware of the missed potential in that process.

Rach has come to Capable NZ from a role in professional development for teachers where she has been endorsed by the Ministry of Education as a facilitator in Digital Technologies, as well as Cultural Capabilities Professional Development. She has written the School Curriculum component of this piece from her experience working with kaiako in Year 0 to 13 classes, and has included resources used by teachers in classrooms today.

He Kōrero Whakataki

In this report, we are aware of a careful line we tread. In exploring curricula implications of decolonising forces applied to computing we are not trying to prescribe the curriculum and most importantly, we are not trying to circumvent doing it properly in partnership. We are several steps before the stage of developing a curriculum, taking a respectful design approach (Reitsma et al., 2019) to trying to nudge a process into one that is te Tiriti-honouring.

This work was prompted by a restructuring of the vocational tertiary education sector whereby the polytechnics, institutes of technology and industry training organisations are merging as Te Pūkenga. As part of this process, computing qualifications (including Business Computing, Information Technology, Computer Science etc) will be unified within single programmes at certificate, diploma and degree levels. Although this document focusses on vocational computing, we believe it will be useful for computing education at other levels and contexts, and the kaupapa useful for other disciplines.

The opportunity is for a unification process that goes beyond deciding which version of Networks 3 should be adopted, to one that is truly transformational.

It is likely that an outcome of transformation and unification will be a te reo Māori version of each qualification and a "mainstream" English version. The Social Report (Ministry of Social Development, 2016) found that, while 55% of the population who identify as Māori reported they could speak more than a few words or phrases in te reo Māori, for only 23% was this "very well" or "fairly well", and it is no better for rangatahi (young people). So, it would be a mistake to rely solely on a te reo version to carry the load here – the mainstream version has to decolonise too.

What we are trying to do is open the eyes of a system that may think things Māori have nothing to do with learning how to write efficient code or implement network protocols (for example). This systemic shortcoming is mostly not from a position of arrogance but a genuine bewilderment about how you could teach a thing that is seemingly culturally-independent and abstract in ways that better align with te ao Māori. We simply do not have models of practice to lean on here. This is not unique to computing education. In discussing frameworks to support science and innovation, Ruckstuhl et al. (2019) observe that "there is no template on how to bring Māori issues (kaupapa), processes (tikanga), and knowledge (mātauraka) into rapidly developing high tech domains" (p. 73).

The essence of this report is that, rather than dismissing mātauraka Māori as not relevant to computing, or shoe-horning it into predetermined technical curricula, we should consider the potential for the computing profession to contribute in a positive way to a thriving Tiriti-based Aotearoa. To do this, we first come to terms with computing as a colonising force.

IT Career Pipeline

Following earlier initiatives into the future of work (NZ Productivity Commission, 2019), the New Zealand Government is developing a series of Industry Transformation Plans. Information Technology is one of those (MBIE, 2022). As part of that work, a taskforce produced a Digital Skills and Talent Plan (ITPNZ, 2021) whose recommendations would inform the Industry Transformation Plan. Recommendation Five concerns Māori: “Māori to be a crucial partner in skills”.

The Digital Skills report includes the culture of work in a useful skills pipeline model that shows that the engagement of Māori reduces from being seemingly enthusiastic at intermediate school to a low 4% of IT professionals (17% population) and an even lower percentage in highly skilled and leadership roles (MBIE, 2015). This report does not say it, but the engagement in the IT industry is even lower for Māori women.

We take the premise that the IT pipeline – both education and industry – has failed Māori, and asks what, in the light of Te Pūkenga’s moves to a transformational unified curriculum, might be done about it?

Digital Skills and Talent Plan. Recommendation 5:

A future digital technology sector for Aotearoa New Zealand requires progressive thinking to realise Māori success. To achieve rangatiratanga in the digital sector, several factors need to be considered as critical:

- A recognition that the principles of te Tiriti must be fully incorporated in how the digital technology sector’s skills and education systems work if it is ever to serve Māori well.
- A recognition that the current system has failed Māori. To remedy this failure, there needs to be significant changes in the way the digital technology sector skills pathways are designed and services delivered.
- An acceptance that remedying decades of under-performance by the digital technology education sector and pathways will require changes so that Māori expertise and more effective services can be designed and embedded into the system.

As well as ensuring authentic learning for Māori at all levels, integrating tikanga (customs and values) and te ao Māori (Māori world view) across all components of the skills system benefits all New Zealanders (p. 20).

We are asking people to imagine a computing profession that positively contributes to a thriving Titiri-based Aotearoa. And then how vocational education can contribute to that?

There are several aspects to creating an experience that is more “welcoming” (MBIE 2022). In keeping with Ka Hikitia, the Māori Education Strategy (Ministry of Education, 2020) and Te Kura Tapa Whā (Welch et al., 2021), learning experiences that have appropriate tikaka and kawa, being “by Māori for Māori”, ako and tuakana-teina pedagogies, and having appropriate support (financial and learning) should make a big difference. But the focus in this paper is on the design and content of the programmes themselves – the curricula.

To be clear, approaches such as cultural competencies in the classroom are necessary but insufficient. We need to go beyond these baseline changes that apply to all disciplines and focus on the opportunities of each specific discipline – what we teach. So alongside cultural competency frameworks such as Tātaiako (Ministry of Education, 2011), we need to develop te Tiriti-honouring curricula.

The first step in curriculum development is to understand the profession we are producing graduates for, and how it relates to wider communities and environments. As the pipeline described, the inequities for Māori continue into the profession but beyond even these low statistics, we see inequities persist in access to services, a continuing neo-imperialism of the multinational such as Facebook, and complicity in conspiracy beliefs within marginalised groups (Rangiwai, 2020). But the concept of computing as a colonising force is underexplored and there is little guidance as to what “decolonised computing” might look like – or even just computing as a positive force in decolonisation. So the nature of computing as a colonising force must first be considered.

In this report we describe initial work towards the vision of a computing profession that positively contributes to a thriving Titiri-based Aotearoa. The intention is that we can then work backwards to derive a set of design principles that combine Te Pae Tawhiti (Te Pūkenga, 2020) and computing pedagogy. Then we hope to redesign programmes on that basis. The intention is to inform national discussions around the relationship between Māori and computing.

The “we” at the top of this page is our small bicultural partnership; we hope that the “we” in the rest of the journey is a much wider partnership that can be considered te Tiriti-honouring.

Computing as a colonising force

Computers weren't invented when te Tiriti was signed. This is not to say that both parties did not have complex information structures because they did – both cultures had intricate (but different) representations of information for navigation, for instance. But the computer as we know it did not appear until the 1940s, emerging as a tool for government and business in the 1960s, and for ordinary people from the 1980s. So how can it be a coloniser?

Toyama (2015) wrote that technology amplifies human forces, and, we argue, the dominant force in New Zealand was, and continues to be, colonialism. Our almost romantic vision of settler families arriving in tall ships belies the establishment of systems to benefit the coloniser. Crucially, it involves a set of unequal relationships between the colonial power and the colony, and between the colonists – or colonisers – and the indigenous population – or colonised. Systems are imposed that benefit the coloniser. And those forces and systems have continued (Smith, 2013), and are amplified by the computer.

Dourish and Mainwaring (2012) wrote of "ubicomp's colonial impulse". Their ubiquitous computing is the notion of computing being everywhere, not in the sense of thousands of tiny computers, but in the sense of pervading all our systems – everything we do is mediated by the requirement to reduce it to data. Such ubiquity comes with the continued domination of a centre with presumption that the periphery needs to "develop". This centre might be either an actual place – San José say – or a metaphorical technological centre. There is also a presumption of a need for innovation – that there is a problem that needs fixing – and only the technological centre has the imagination and agency to do so. With the idea that the technologists are, in some sense, typical people, the problems that we encounter now are the problems that everyone will have soon. Thus, technology comes with an homogenising assumption, a one size fits all, but that size was created by and for someone else with little concern or understanding of local requirements. Worse, the "logic of lack" denies agency to develop solutions, and "to put technology to use in (one's) own context and develop own meanings in complex, messy and multifaceted contexts of everyday practice" (p. 135). Further, the technologists are positioned as "plain folks" who happen to be in privileged positions of being advanced technologically, so in seeing problems as their own, the problems to be solved are those of technology. And everyone is a user of technology or will be soon: "it allows no position other than 'user' or 'non-user' as the reference point for understanding people and their contexts" (p. 135). And such context becomes moot when imposed solutions are of universality and quantification.

Quantification is a universalizing process…it renders the elements of the everyday world comparable and trackable (stemming from) its particular dominance as a logic of control. (p. 137)

Illogical Admin Barriers

“Kia ora, Mawera speaking.”

“Oh, um, kee or-ra… Mar, um… Maaa, um… sorry, is this Jack’s caregiver?” asked the person on the phone.

“Kia ora, this is Mawera, Jack’s mum. Who is this, please?”

“This is Whakatane Hospital calling. I am calling about Jack’s referral to see the paediatrician.”

“Oh, cool, thanks. When can he see the doctor?”

“Well, Maa.., Mar…, well we don’t seem to have a birth certificate on file for Jack, and until we sight one, we are unable to make an appointment.”

“Excuse me? I think you have the wrong person.”

Caller provides Jack’s full name and address.

“I think there must be some kind of mix up. Jack is Māori, was born in Whakatāne, has had one doctor his whole life and has been to the ED twice for falling off things. What do you mean you can’t make an appointment for him?”

“Well, um… there is a policy that we must have the birth certificate in the system before we can book an appointment.”

“Yes, you said that, but it still does not make sense. My son was born in Whakatāne, has a NHI number that is used in hospital and by his GP. He has only had one GP his whole life and I am his mum, also with a health number, also Māori, and also previously been to Whakatāne Hospital.”

“But the rules are the rules. If you don’t like them then you can choose to go to a private specialist and pay for private treatment.”

In short, if technology does not make things better for you, then there is something wrong with you, your education and your cultural understandings, not the technology.

So far, we have two interrelated forms of colonisation. First, the structural colonialism of the state and organisation, creating structures and processes to the benefit of the system. And second, the technological colonialism, imposing universal logic and encoded solutions.

The interaction here is multiplicative, not additive. The interaction increases the likelihood of either – Reitsma et al. (2019, p. 2) write of design, and the logic holds here: “the use of design within the context of indigenous communities raises concerns. This has to do with the characteristics of design to ‘improve’ lives and its emphasis on innovation.” And it happens faster, and at scale. As Taiuru (2020) describes, “[as we] move from the physical world of inherited bias and unconscious racism to now being applied to the digital ecosystem. The issue with the digital ecosystem is that the impacts are exponentially faster and the consequences are mammoth” (p. 9).

But, one might argue, surely most of computing is independent of culture, algorithms are abstract sequences of instruction devoid of value statements, similarly networks are merely complicated switches and cables – and there are strong biases encouraging that view (Hankerson et al., 2016). But, taking a Freirean view, this apparent lack of values exposes the normalisation of the oppressive culture. Winner (1980) argued that artefacts are actively imbued with the political values held by those who created them, and Barad (1996) that knowledges are not innocent.

Torreta and Reitsma (2019) argue that knowledge is not neutral. Writing of Industrial Design, they argue that it “emerged from a specific nature/culture and political situation; it is therefore a situated field that echoes the worldview of where it was created”. In computing’s terms, an apparent lack of values does not mean technology is benign; rather, we have come to presume that efficiency, speed and productivity are values that match societal aspirations.

Yet, it would be foolish to throw the baby out with the bathwater. Even in describing the dangers of artificial intelligence that fail to account for te ao Māori, Taiuru (2020) argues that “digital technologies have a key role to play in advancing solutions to complex areas affecting Māori” (p. 8).

Algorithm Barriers

You want a mortgage. It doesn't matter how much the bank manager might know or trust you, if the algorithm says no, on the basis of predetermined binary classification that may or may not fit your situation then there is no room for compassion. Since the establishment of the Treaty of Waitangi, Māori worked with central and local governments to develop papa kāinga (family housing settlements) on Māori-owned land. Successive governments have supported the idea of papa kāinga, while at the same time creating policies which make it increasingly difficult for Māori to achieve success. One of those barriers is the almost complete inability to borrow money from a mainstream bank to build a home on land owned by your family. There is a housing crisis. There is a cry from commentators to develop Māori land for housing. There are so many barriers it is close to impossible to achieve. There is no compassion, and no consideration of cultural values.

A legacy of distrust

Joseph Selwyn Te Rito (2007) credits Sir Apirana Ngata for encouraging Māori to embrace “te rākau ā te Pākehā” (the stick or tool of the pākeha) as a useful tool for recording whakapapa to hold on to their culture for their emotional wellbeing. He described the pen as a:

“*new technology for their physical well-being; and to acknowledge the spiritual creator for their spiritual well-being… In the 1800s, Māori people grasped the writing ‘stick’ (pen), and proceeded to write whakapapa down. Today, the new ‘stick’ is the computer*” (p. 4).

Or as Ali (2016) argues, is there no modernity without colonialism? Te Rito’s perspective contrasts with those who say the pen was the end of a centuries-old oral tradition and the loss of mana for those who shared the stories.

Taiuru (2020) describes his first forays into professional computing in the late 1990s: “…but at the time IT was frowned upon by many kaumatua and the very few Māori who were in the industry at the time” (p.7). This, he argues, is because of the link between computing and authority, and it continues today:

Māori are already suspicious of the government due to colonialism, oppression and intergenerational trauma, which makes Māori susceptible to belief in conspiracy theories (Rangiwai, 2020 p.47).

Intergenerational Fear Barriers

In a small, isolated rural community, high in the hills of the Bay of Plenty region on the North Island, a boy was afraid. The Boy loved school. He loved learning, being with his mates, playing Rugby, his teacher, catching the bus, the bus driver, eating lunch, drawing, reading books, running, and everything about school. He was smart and good at lots of things. School was the best thing in his life. But he did not like doing anything on computers. Koro (his grandfather) told him that computers are a waste of time, and the internet was bad. He had lived with Koro since he was born, and Koro was old. OId people know heaps of stuff so it must be bad. Now “The Covit” was trying to kill the people, so he was not allowed to go to school. Even worse, Teacher had told him he had to use a Chromebook to do schoolwork at home and he knew Koro would not like that. Stupid Covit!

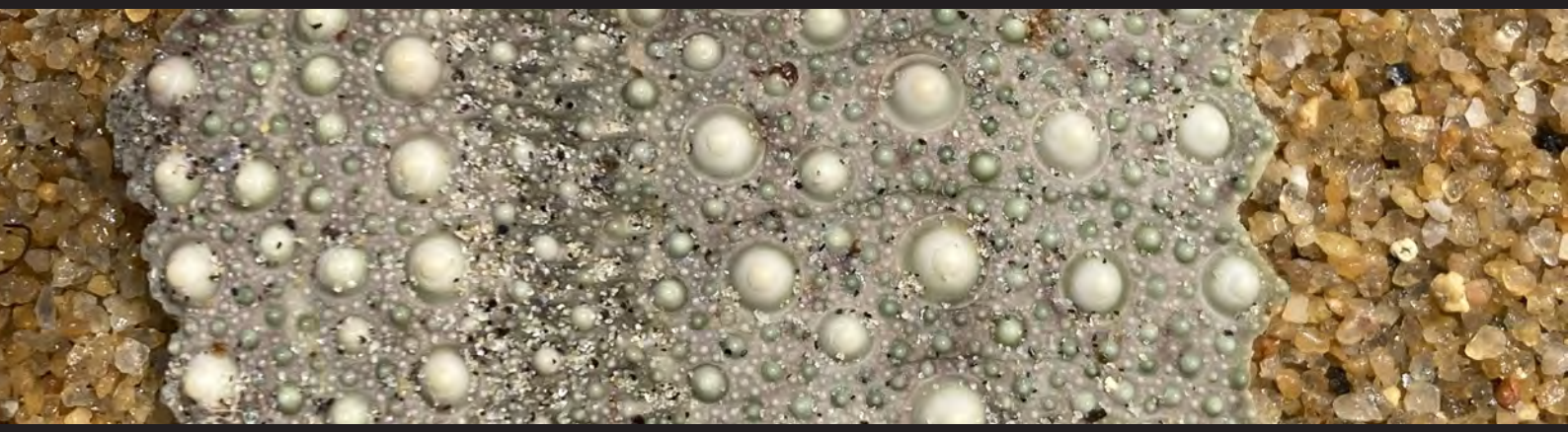
Teacher knew there were going to be challenges for The Boy using his Chromebook at home. Koro was her uncle, and she knew how he felt about technology. He was old-school. He was brought up at the feet of his own Koro, attending hui (meetings), learning tikanga (customs) and te reo Māori (language) of his people from that generation that had fought against colonisation to hold on to their identity. He had been forced to attend a Native School where he was punished for speaking his own language and forced to speak English. Forced to learn ways of being that were not his. Forced to learn the skills to do a job he would never do, working for Farmer so that Farmer could farm land that was stolen from Koro’s family. None of that was going to make this easier. Koro would only ever see computers as the modern Native School. Stupid Covid-19!

“Kao, Girl, I am not having that thing in my house. Get rid of it! Don’t you know about a 5G that is spreading The Covit. I’m not having a 5G here, making us sick.”

“But Uncle, The Boy needs it to learn. School is closing the doors, but the government says the tamariki still have to go to learn.”

“Learn, Girl? What do you mean by learn? Are you saying I can’t teach The Boy?

What a predicament Teacher finds herself in. She knows that this conversation will be had around the country, especially in isolated rural communities, especially for Māori who already have a strong distrust of mainstream education. However, in every story is a moment where there is the potential for change. A moment where we have choice and where that choice will materially affect the outcome. Should Teacher ignore Koro’s fears, and force a change on him and his life, insisting that The Boy use the computer? Or does she work harder to help Koro see the benefit of the digital tools available for Māori, as a means of protecting knowledge for the future and bring him to a place where he can make the decision himself?



Decolonising computing

Is it sensible to demand that computing honour te Tiriti? As we said earlier, the technology did not exist in 1840. Yes, we know, Babbage, but also Māori concepts of data, now recognised as taonga (WAI 2522). While not explicitly about computing, the Waitangi Tribunal Claim 776 – that of allocation of radio spectrum, is useful here. The Tribunal found that the Treaty "was not intended to fossilise the status quo" and is "a living instrument to be applied in the light of developing circumstances. In signing te Tiriti, Māori expected that European colonisation would allow them to share the benefits, including the technologies, of those peoples". (WAI 776 2.4.2(1) p.19). This sharing "must be a real sharing, in which Māori participate as owners and managers, possibly in joint partnerships, and not merely as consumers" (WAI 776 3.3.5). This finding combines with the earlier rulings that the government must use broadcasting assets for the revitalisation of te reo Māori (WAI 26, WAI 150). If we extend that logic to computing, Māori can expect that they share in the benefits of the new technology, and the government is responsible for using it to benefit Māori in so far as it is able through systems of education, as producers not just consumers – and it must do so in real partnership.

This sets the blueprint for curricula reform in digital education. It is useful for us to go beyond this procedural argument and consider what decolonised computing might look like, and then what this might mean for vocational computing education.

There is a deep and growing literature in decolonisation. What might this tell us about decolonising computing?

In a global context, Betts (2012) described how the concept of decolonisation formed from a political phenomena of the 1960s with the creation of self-governing states, which "soon extended to all elements in the colonial experience political, economic, cultural or psychological". This process is of course complicated by the continuing forces of colonialism, and particularly, that the intertwining of development and modernisation:

The discourse of modernism, in which the rhetoric of empire was formed, emphasised the rational and the orderly, praised the technological improvements that assured the West its only field of superiority, and rejoiced in an attitude of imagined differences that allowed terms like 'primitive' and 'backward' to stand as antonyms for the nouns 'progress' and 'betterment', these last two providing the themes of the meganarratives that gave unity to that age's endeavours and imposed their cultural bias on the world at large (Betts 2012, p. 31).

Rashied and Bhamjee (2020) asked what the Global South needs to do to decolonise the fourth Industrial Revolution. All the Industrial Revolutions can be seen as colonising, including the computational Third IR and the Fourth IR with greater integration of physical, mechanical and

Māui Studios Aotearoa

Māui Studios is a kaupapa Māori production studio that develops digital content grounded in mātauranga Māori, tikanga and tipuna values for local and global audiences.

Co-founder Vincent Egan says “we like to focus on solving communication problems that involve knowledge sharing, which also promote cultural competency and commercial sustainability. Putting bespoke digital technology and content solutions in place requires both technical and cultural capabilities.”

digital systems. The effect of this digital integration has been to further reinforce the inherent colonial nature of industrialisation upon wider and deeper aspects of society and the environment. For Rashied and Bhamjee, the answer is to identify a post-development ideology that enhances (or at least does not sacrifice) value systems, sovereignty and diversity, and then to cultivate a digital environment to enable that.

Tuck and Yang (2012) warn us to avoid the mistake of using decolonisation as a metaphor for human rights and social justice, but demands an indigenous framework, land sovereignty and indigenous ways of thinking.

In the New Zealand context, Smith (2012) describes what a decolonising response might be:

Decolonisation, once viewed as the formal process of handing over the instruments of government, is now recognized as a long-term process involving the bureaucratic, cultural, linguistic and psychological divesting of colonial power. (Smith, 2012, p. 98).

Sherwood and Anthony (2020) describe a strengths-based approach to Indigenous ethics:

We argue that Indigenous people should not be classified as a disempowered vulnerable people but as an empowered yet oppressed peoples through Western constructs situated within colonial structures. The shift in language respects and accepts that Indigenous people are experts in their lives and knowledge holders of their communities, cultures and countries, yet are in constant struggle with colonial relations, including research bodies that remain detached, aloof and considered by themselves as objective (p.20).

Using this strengths-based approach we can look to Māori successes in computing. The first Digital Strategy (NZ Government 2005) identified "Māori Digital Practitioners" as being fundamental to New Zealand's continued prosperity. Unfortunately, as Weatherall et al. (2009) described, when we asked who these people were, we were always given the same three or four names – hardly enough on which to base an economic strategy. Now, 17 years later, there are 700 people contributing to a group of Māori Digital Practitioners (Taiuru & Mann, 2022). The current Industry Transformation Plan uses "Māori Digital Ecosystem" in a similar sense, and there are wonderful examples of organisations operating at the sweet-spot of culture, technology and business (Māui Studios and Kiwa Digital being prime examples).

In this framing we need to focus beyond the negative critique of constructions of cultural difference, and "on the productive possibilities of difference itself" (Philip, 2010, p. 5).

The seams among differences are not simply a source of undesirable unevenness and aberration, but also sites of creativity and possibility. (Philip, 2010, p. 5).

These seams are where we need to be looking for our curriculum. Philip challenged us "to critically interrogate techno-deterministic objects and systems through a sensitivity to difference in culture, power, history, politics, knowledge, and practices in all their complexity and diversity." (p.5). So, we return to the question posed above "But I teach students to write code, what does this have to do with me?"

Karaitiana Taiuru (2020) has long worked in IT. Most recently he was advising a medical school on te ao Māori implications of genome research. He has explored extensively the implications of Māori data sovereignty, Internet of Things, and social media (Taiuru & Mann, 2022). Taiuru's (2020) example of Atamai Iahiko (artificial intelligence) uses the five-step Tikanga test, also known as the Mead test, developed by Sir Hirini Moko Mead (Mead & Mead, 2003). One is left wondering how anyone could do AI without mātauraka Māori. Asked if the same rich understanding might be found if he were to turn his eye to other areas of computing – networks, databases – Taiuru's reply is "absolutely, we've just started" (Taiuru and Mann, 2022). Indeed some areas of computing have had this richer treatment – social media (Waitoa et al., 2015) and spatial technologies (Hakopa, 2011) are useful examples.

A useful approach might be to look for "silenced values" (Scheuerman et al., 2021). In exploring the values inherent in computer vision datasets Scheuerman examined the documentation and found many hidden values that sat in opposition. So they were able to conclude that the dataset creators value efficiency at expense of care; impartiality at expense of positionality; universality at the expense of contextuality; and model work (effort in describing new technique) at the expense of data work (effort in exploring complexities of data). It could be that what we seek is there, we've just been hiding it.

School Curriculum

The process the school level education went through in re/developing the Digital Technologies / Hangarau Matahiko (DT/HM, Ministry of Education, 2017a, b) curricula is useful scene-setting. Crucially, as a first observation, it is not a direct translation. For example, the introduction to Technology:

What is technology about?

Technology is intervention by design. It uses intellectual and practical resources to create technological outcomes, which expand human possibilities by addressing needs and realising opportunities.

Design is characterised by innovation and adaptation and is at the heart of technological practice. It is informed by critical and creative thinking and specific design processes. Effective and ethical design respects the unique relationship that New Zealanders have with their physical environment and embraces the significance of Māori culture and world views in its practice and innovation.

This is not directly comparable to the equivalent statement in Hangarau (Ministry of Education, 2017a):

Te Whaitake o te Ako i te Hangarau

Me whaitake ngā kaupapa hangarau kia kore ai e whāia mō te kore noa iho.

Mā te hangarau ka tū rangatira ngā ākonga. Hei whakahiato i ngā mōhiotanga hangarau, ka tīmata i te ao Māori me tōna hāngai ki te ao hurihuri. Me aro anō ki ngā uara, ngā pūkenga, me ngā mōhiotanga hangarau o te ao e taunga ana ia.

The Importance of Learning Technology (our translation)

Technical projects must be relevant so that they are not pursued for nothing.

Technology empowers students. To gather technical knowledge, we begin with the Māori world and its relevance to the changing world. They must also focus on the values, skills, and technical knowledge of the world they are familiar with.

It might be a subtle difference, but we believe it is significant. The English version puts technical intervention first; the te reo version prioritises the Māori world.

Second, we observe that this subtle difference in philosophy is played out in a different structure. For the New Zealand Curriculum in English, these technology changes came in the form of two new technological areas and progress-outcomes for each. These focus on computational thinking and developing digital outcomes. Key to both of these was the focus on end-users, that is; what do we design for people and why?

For the Mātauraka o Aotearoa Curriculum in Māori-medium kura these Hangarua changes came in the form of two new tupuranga (areas of growth). These focus on te reo and tikanga, digital citizenship and computational thinking. Key to both of these is a focus on understanding the past to inform the future, and connecting traditional Māori practices and knowledge with contemporary skills.

A Tale of Two Little Boys

Once upon a time there were two little Maori boys - John and Bill, both aged 12 years old.

John came from a family where education was a priority, where technology was embraced and where it was expected that he would co-create a plan for his future.

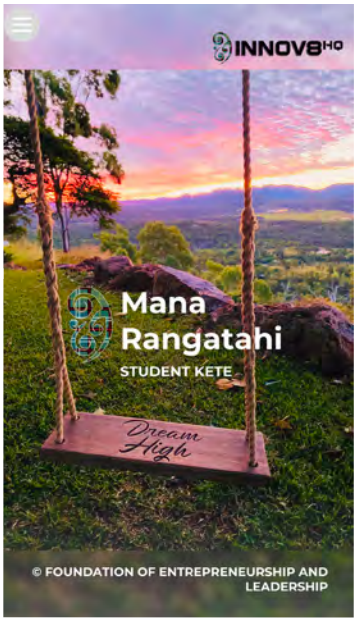
Bill came from a family where there was intergenerational unemployment, gang affiliation and where there was little faith or engagement in education, or any other “system”, for that matter.

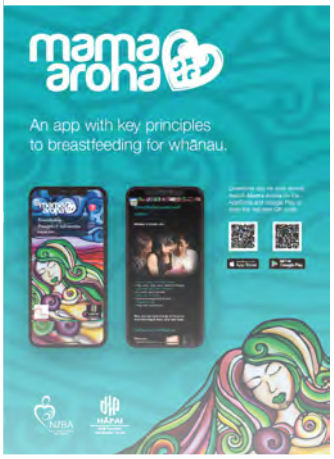
Growing up in two very different lives, eventually the two boys met at intermediate school, and became fast friends. The friendship had a profound effect on both boys. John became aware of the privileged life he lived, and Bill became aware that there was another pathway through life. Bill’s school attendance improved and he began to develop a sense of creating his own future. John developed an awareness of the power he had to influence change.

Towards the middle of their second year at intermediate, the boys began discussing high school. One day the boys sat down with John’s mum to talk through the options for their first year of high school. John decided on te Reo Māori, Mechatronics, Coding and Food Tech, and decided he would join the robotics club. John’s mum asked Bill what he would like to do and he said, “Whaea, I know what te Reo is, but I don’t know what any of those other things are.” John’s mum stopped, and realised she had to start again. “Bill”, she said, “in all of our lives there are barriers between us and our goals, but there is always a way to get past them. The bravest thing in the world to do is to ask for help, or to say you don’t understand! You are so brave!”

Over the next few days, Bill, with John’s mum, spent a little time each day creating a future. It began with setting a long term goal for grown up work, and then they began breaking down the subjects at high school, so Bill understood the value of each and could make an informed choice. Bill, with John’s mum, wrote down the plan so Bill could take it home and discuss it with his family. Only his family did not want to discuss it. Bill told John’s mum there was no way he could see to make things work and that his parents did not understand the subjects, or why he wanted to learn the subjects he chose, or why he wanted to go to a different school from the one all his siblings had gone to.

John’s mum knew how important this was, so she wrote a very long letter to Bill’s parents. She wrote about the relationship between the boys, their aspirations, and the choices Bill would have in his life if he had the chance to take these first steps. John’s mum wrote about the future Bill imagined for himself, and explained the benefit of each of the choices he had made. A few days after John’s mum sent the letter, Bill came to visit and told her his family told him “it’s weird, but you can go to that school and learn those things.” John’s mum never heard from Bill’s family, but she knew that they had seen her message and together she and Bill had set him on a positive pathway to the future he had imagined for himself.





Kiwa Digital

Aotearoa-based, Māori-led technology business, Kiwa Digital is revolutionising the global language services industry. Core to the success of the company is its cultural services software, enabling translation, indigenous voices and knowledge sharing, deeply steeped in te ao Māori, and traditional Maori values.

Kiwa Digital Kaiwhakahaere Matua, Steven Renata (Ngāpuhi, Ngāti Pakahi and Ngāti Rehia) says “There’s so much to be learned from mātauranga Māori ... and being Māori can be your competitive advantage since we come from a strong whakapapa of navigators.“ He sees te ao Māori as an important link, connecting the global tech sector, by “improving understanding between nations and cultures using technology to enable the world’s voices to be heard authentically.”

The Kiwa Digital team are motivated in the pursuit of language preservation, and improving literacy and cultural capabilities. Bringing more rangatahi Māori into the tech industry and building competency in te reo Māori are high on their measures of success.

Across the English and Māori medium, there are key components of the digital technology that occur similarly, such as intervention by design, for humans-by-humans. Both also link to local curriculum because running concurrently with DT/HM has been a drive for change towards local curriculum development which sets context for learning about, and problem solving issues in, the students local learning environment. This has enabled focus on relationships for learning, strengthening collaboration, a future focus on learning pathways and ensuring rich opportunities for learning using DT/HM.

From the end of 2017 to the end of 2020 the Ministry of Education (MOE) provided funding for kaiako (teachers) and tauiwi (students) from Year 0 to 13 across the motu (country) to engage in professional learning and classroom learning respectively around changes to the Technology Curriculum.

The third observation we make is that the English DT curriculum and its delivery is informed by mātauraka Māori. The redevelopment was aided by the resources developed in Kia Takatū ā-Matahiko/Digital Readiness (KTaM, a website commissioned by the MOE and created by Core Education, University of Canterbury and other providers), amongst other provisions. These KTaM resources were all based on the legend of how Māui brought fire to the world, and in particular the relationship between Māui and his kuia (grandmother) Mahuika. The characteristics of each were drawn as qualities needed for innovators of change, and encouraged kaimahi and tauira to move from being consumers to innovators of change by utilising

these qualities, for example the curiosity of Māui and the patience of Mahuika.

Key to the KTaM resource was that, for the Māori medium resources there was no English translation, but that this was the first resource created that had equal focus on English and te reo Māori. Pīkau/online toolkits were created for Hangarau Matahiko and Digital Technology that explained changes, as well as providing practical examples and resources for teachers. All shared the characters of Māui and Mahuika, as well as the focus on making people-focused change.

He Kōrero Whakakapi

In conclusion, and recognising that this is the start of the journey, we conclude with some recommendations. These should be considered in tandem with those things we have taken as base requirements – tikaka, ako pedagogies, learning support etc.

A potential barrier to a decolonised computing curriculum is a perceived lack of space, a feeling that "we can't fit Māori material into a schedule that's already full of core computing". But, we argue, this would be the wrong way of looking at it. In writing on the reform of music education, Bennett (2016) uses the unfortunately convoluted term "Anupholesteraphobia" – the fear of not being able to cover all the material. Rather than something to cram into an already overcrowded curriculum we can take from Bennett the approach of seeing mātauraka Māori as the context for computing, a basis for deeper learning, or even a reason for learning. As Ruckstuhl and Martin (2019) argued, the integration of mātauraka Māori with technology usually quickly arrives at the cutting edge of both – they call this Tihi, or summit research (and hence their Te Tihi o te Maunga Science and Innovation Framework).

Ruckstuhl et al.'s (2019) model of absorptive capacity may be a useful framing. Figure 1 reframes this model for our context. It shows mātauraka (technical capacity) integrating digital technology knowledge and pedagogical knowledge. Also their single dimension researcher/industry is expanded to a context of education (including learners), the computing industry, Māori and Tau Iwi (everyone else).

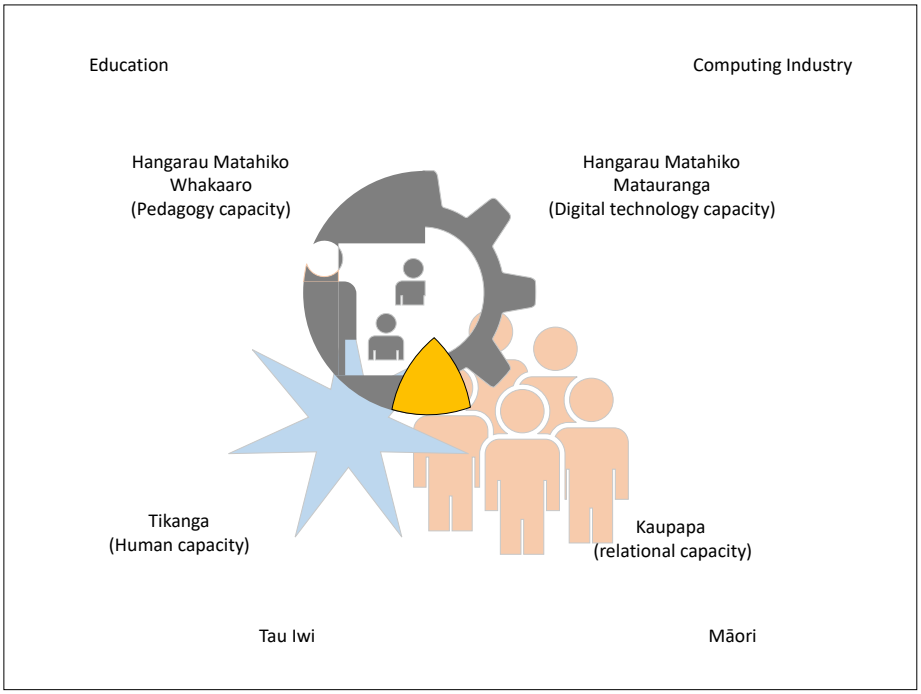


Figure 1: Absorptive Capacity model (after Ruckstuhl et al. 2019).

Recommendations

1. Recognition that the current education pipeline (including practice) has failed Māori.

Decolonisation starts with understanding the impact of one's own position and privilege.

Value sensitive design (Friedmann & Hendry, 2019) starts with recognising that we are all defined by some sort of privilege.

2. Partnership – we need to enter this process with the expectation and appreciation that the outcome will be different than if it was not a partnership.

This will take humble design (de Jong, 2016) and radical listening (Torretta and Reitsma, 2019).

3. Imagining a computing profession that positively contributes to a thriving Titiri-based Aotearoa is vital.

Only then can we begin to consider how vocational education can contribute to that vision.

4. The "mainstream" (English) programmes must have mātauraka Maori as a basis.

Given that it is likely that each curriculum area and level will have a te reo Māori version and an English version, we believe it crucial that both take this decolonisation challenge seriously.

This is not instead of technology, science or business epistemologies and ontologies. Indigenous ways of knowing – ways of observing, discussing, making sense of new information – can coexist with western models (Blasser, 2013).

5. Mātauraka Māori needs to be thoroughly explored as a lens for the curriculum for all of computing.

Following the lead of Taiuru (2020), we need to operate in the intersection of indigenous and computing knowledge.

6. Whakapapa and Tikaka needed to act as NZ IT practitioners

For example our graduates need to know the implications of "data is a taonga".

7. Mana motuhake as a basis for standing on the world stage

We need to articulate, develop and promote a professional identity for NZ IT practitioners.

As Aotearoa New Zealand computing professionals, our graduates need to understand and own concepts such as Māuitanga for innovation

8. Takoha – this will require change, which might not be right the first time. We need to be bold, yet humble.

This last recommendation takes inspiration from Tarena (2016) who, when writing about indigenising the corporation, argued that standard methodologies will not work:

Saving a language, revitalising a culture, restoring cultural ecosystems these are not simple technical problems with known fixes; these are large messy adaptive problems that require time, learning, and experimentation (p. 37).

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