



Wāhine tapuhi ō te parawhenua mea kia mataara- Wāhine-led, community-based research on earthquake resilience

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ABSTRACT

Despite increasing attention on the importance of earthquake risk reduction for Aotearoa New Zealand communities, there are limited Māori-medium resources available, and more representation of Māori wāhine (women) researchers is needed within the field. This paper explores the research initiatives of three emerging wāhine researchers, utilising a range of novel approaches to engagement and collaboration including traditional story-telling, Mātauranga Māori (Māori knowledge) and design technologies to increase resilience for Māori communities from tamariki (children) to kaumatua (elders). Te Hiko i a Rūaumoko (Rūaumoko's Walk) is a bilingual pukapuka (book) based on Ngāti Kahungunu iwi (tribe) pūrākau (stories) that relate to natural earthquake warnings and preparedness within their region. This project is digitising the printed picture book into an interactive medium with animation and information pop ups for the benefit of kaiako (teachers), whānau (extended family) and tamariki. The second project is an educational outreach programme piloting a tuakana/teina (sibling) mentorship model for high school and primary school-aged students enrolled at Māori-medium schools in the Hawke's Bay. The project is framed by the Te Whare Tapa Wha health model to create a holistic understanding of earthquake and tsunami risk. The final project has woven local knowledge, Mātauranga Māori and western science to communicate historic and contemporary tsunami risk and resilience information using reciprocal and interactive public memorial events and hui (gathering) in Wharekauri-Rekohu (the Chatham Islands). Weaving together these three projects is a wider narrative of ethnographic reflection

exploring the role of three emerging wāhine researchers collaborating in the discipline of seismic research and the challenges and successes involved within this.

1 MIHI- MĀORI GREETING, ACKNOWLEDGEMENT AND TRIBUTE

Whakatauki (proverb acknowledging the collective)

Ehara taku toa i te toa takitahi, engari he toa takitini.

Ka nui taku koa i tā koutou whakaae mai/kaingākau ki te tautoko i tēnei kaupapa.

Nō Te Waipounamu a Lucy, nō Kai Tahu ia, ko Ngāi Tūāhuriri tōna hapū.

Nō Wharekauri me Rēkohu a Kristie-Lee, he uri nō Ngāti Mutunga o Wharekauri.

Nō Ruatoria a Emily, he iti nō Ngāti Porou, ko Te Aitanga-a-Mate tōna hapū.

He kairangahau a Lucy rātou ko Kristie-lee ko Emily. Heoi anō tā rātou, he poipoi i te marea ki te āta whakarite i a rātou anō mō te tūpono ka oreore a Ruaūmoko, ka hua hoki mai he parawhenua mea.

2 MĀ TŌ ROUROU, MĀ TŌKU ROUROU, KA ORA AI TE IWI- INTRODUCTION

Earthquakes and tsunami are hazards to which communities on the coastlines of the East Coast of the North Island and the Chatham Islands of Aotearoa New Zealand are particularly vulnerable, due to the proximity of the Hikurangi Subduction Zone. Because of the risk of near-source tsunami (which can reach land within minutes of any natural warnings) it is important that communities know what to do and where to go. Despite the fact that Māori have an extensive knowledge of their local rohe (region) and the historical and contemporary movements of Rūaumoko (the Māori ancestor of earthquake, volcanic and geothermal activity, see Taute, Fa’au, & Ingham 2019) and Parawhenua-meā (the personified form of the waters of earth, associated with tsunami) their capacity for understanding, planning, responding and recovering to earthquake and tsunami events is often not appropriately recognised within mainstream hazard education resources. A historic trend towards top-down approaches to earthquake and tsunami risk reduction and resilience planning in Aotearoa New Zealand has meant that the voices and expertise of local communities has been marginalised. Supporting community-based and community-led research is a mechanism that can ensure a better understanding of communities and the potential for more equity and representation in disaster risk reduction (DRR) and resilience decision making. We would also like to turn the mirror back on ourselves as participants within a field of research in which Māori and wāhine (women) are currently underrepresented.

This paper documents our reflections on conducting community-based research as well as our experiences working within the earthquake resilience discipline. Within the following section (3) of this paper, we provide a background to the contemporary participation of Māori in the academic workforce. In sections 4 through 6 we discuss three case study projects we have conducted separately, our findings and our reflections. In section 7 (collective discussion) we discuss some of the individual and collective lessons we have learned while conducting our research and our experience working in engineering, physical and social science academic systems. This paper concludes with a final section (8) in which we summarise and suggest some paths forward for a more inclusive field.

3 BACKGROUND

Our research is coloured by our own positionality and experiences conducting our work, and by other Indigenous and Māori researchers’ experiences conducting research for communities. Kahanamoku et al., (2020) as an example, discuss several implications for researchers working with Indigenous communities. According to Kahanamoku et al., poor Indigenous representation in academia is exacerbated by limited

support structures for post-graduate trainees and early-career scientists. Additionally, the lack of institutional support for meaningful, consent-driven, and reciprocal engagement with Indigenous peoples may deepen the perception that outreach efforts are performed in bad faith.

Theodore et al., (2016) explain that an increasing number of Indigenous graduates are critical for Indigenous development and reflects growth in the acknowledgement of Māori potential, achievement and success in academia. However, Māori are under-represented as graduates (13% of bachelor degrees in 2018) and in particular as postgraduates (10% masters and 10% doctorates in 2018) considering Māori constitute 15% of the Aotearoa New Zealand population (Education Count 2019b; Theodore et al., 2016). The Graduate Longitudinal Study New Zealand (GLSNZ) found from a sample of 626 recent Māori graduates in 2011 that nearly half (48%) were the first in their whānau to attend university (Theodore et al., 2016). The number of Māori students in tertiary education is on the rise, with 22% of Māori students studying at postgraduate level across the university sector (up from 19% in 2008) and a 26% increase in Māori doctorate students from 2008 to 2018 (Education Counts 2019a).

However, physical sciences and engineering are among the disciplines graduating the lowest numbers of Māori tertiary students (Figure 1). In 2018, only 2% of 29,750 Māori tertiary students chose to complete science qualifications and 5% to complete engineering qualifications (Education Counts 2019b). Theodore et al., (2016) found that a third of Māori graduates were parents, and being a parent was associated with a lower likelihood of studying science and engineering. Only 3% of female Māori tertiary students were completing engineering degrees in 2018 (29% of tertiary students completing engineering tertiary qualifications in 2018 were female). Only 2% of female Māori tertiary students were completing physical science degrees in 2018.

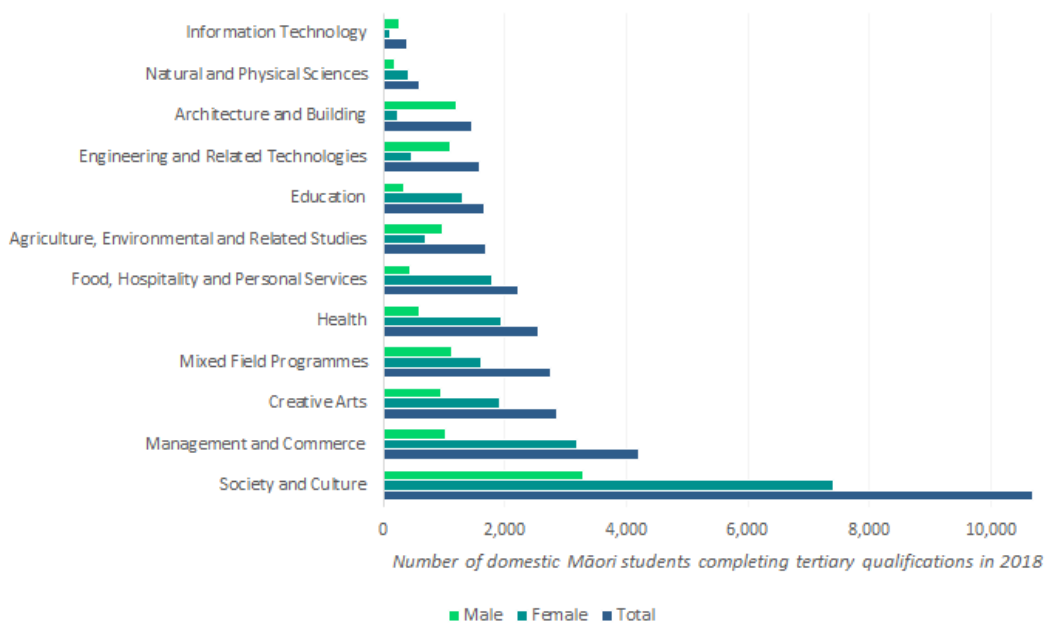


Figure 1: Domestic Māori students completing tertiary study across different fields in 2018. Data adapted from Education Counts (2019b).

Furthermore, McAllister et al., (2019) state there has been no progress in increasing the Māori academic workforce. Between 2012 and 2017 Māori academics were severely under-represented, constituting only 5% of the total academic workforce, and despite a growing number of Māori doctorates and recognition of positive experiences of students being taught or supervised by Māori staff, we have not moved forward (McAllister et al., 2019). This raises serious concerns for the workload of Māori academics and availability of nurture and support for the growing number of Māori students, especially considering increasing incentives for all research fields to align to Vision Mātauranga strategies and allocation of funding to do so (McAllister et al., 2019). In terms of gender disparity in the academic field for Māori, in 2017 43% of Māori

Professors and Deans were wahine, a significant improvement than 2012 when only 20% of Māori Professors and Deans were women. Kidman and Chu (2017) noted that few Māori academics are employed outside of Māori departments. When juxtaposed with the authors' finding that having a Māori manager was the most influential factor in determining Māori academics' workplace satisfaction, it is clear that there is still work to be done in making non-Māori departments culturally safe spaces in academia.

As stated in the Vision Mātauranga Research Policy, "There are many opportunities for Māori communities to make distinctive contributions to research, science and technology. These opportunities lie in the innovation potential of Māori knowledge, people and resources." (New Zealand Ministry of Research, Science, and Technology 2007). Increasing diversity in the science and technology fields requires more work on behalf of our institutions and ourselves as researchers to include Māori knowledge, people and resources in our work. Hiring Māori researchers in our research institutions and on our projects is only one part of the equation; another is conducting research directly with Māori communities and community stakeholders in order to better inform the science we conduct, and to ensure that research is being conducted for the benefit of the communities who are being studied.

The following sections (4.0 to 6.0) offer a brief summary of our community-based earthquake and tsunami resilience work as examples of some ways in which Māori communities can contribute to research as well as how we, as researchers, can serve our Māori communities. The sections also include ethnographic reflections on what we have learned as emerging tangata whenua (Indigenous) researchers while conducting our projects.

4 TE HIKOI A RŪAUMOKO

Te Hīkoi a Rūaumoko (Rūaumoko's Walk) is a bilingual pukapuka (book) based on Ngāti Kahungunu iwi (tribe) pūrākau (stories) and whakaaro (thoughts/understandings) that relate to hazards and preparedness within their rohe. This was developed and piloted in the Hawke's Bay by a collaborative working group led by the Hawke's Bay Civil Defence and Emergency Management Group (HBCDEM) as part of an initial project from 2013-2014 entitled 'Me Noho Takatū' (Be Prepared). Through this project, bilingual resources were produced "to support Early Childhood Education (ECE) kaiako/teachers to engage with tamariki/children and their whānau/families about earthquakes and tsunami" (Ehrhardt 2014) within the Hawke's Bay area. The pukapuka was piloted with six ECE services, encompassing kōhanga reo (Māori language ECE centres), kindergarten and private ECE service types, in early 2014. While this trial distilled knowledge within these communities around earthquakes, "there was little prior awareness of tsunami, and the project represented an important learning curve" for these services (Ehrhardt 2014). Lessons learnt from this project have established the foundations for a second phase of the project which has seen the printed resource digitised into an interactive pukapuka accessible on a range of devices. This will see Te Hīkoi a Rūaumoko traverse the traditional domain of a printed pukapuka to a sensory-based format needed for an online medium. The outcome will be the development of a technologically appropriate, community-based educational resource and pedagogy.

Both phases of the project are driven by United Nations dialogue for a greater global effort to institutionalise children, youth, and young professional engagement in disaster risk reduction and "appropriately draw on their capacities" (UNDRR 2019). A working session on promoting locally-led disaster risk reduction / disaster risk management at the Sixth Session of the Global Platform for Disaster Risk Reduction highlighted that the need to empower "local community is necessary at all stages of disaster management from identification of needs, to awareness raising" (UNDRR 2019). Developing culturally appropriate resources for this sector supports the development of knowledge and skills of tamariki (children), kaiako (teacher/instructors), and whānau (family group) to reduce their risk to hazards and be ready for an emergency event. It will also strengthen the networks between CDEM, young whānau, and ECE services.

At present, 63.9% of tamariki under five in Aotearoa New Zealand attend a licensed ECE service, with 7,864 enrolled in a licensed ECE service in the Hawke's Bay region alone (Education Counts 2019c; Education Counts 2019d). Today Aotearoa New Zealand tamariki are growing up in a diverse society that comprises people from a wide variety of cultures and ethnicities. The ECE curriculum Te Whāriki "acknowledges that all children have rights to protection and promotion of their health and wellbeing, to equitable access to learning opportunities, to recognition of their language, culture and identity and, increasingly, to agency in their own lives" (Ministry of Education 2017). The expectation is that each ECE service will use Te Whāriki as a 'basis for weaving with children, parents and whānau its own local curriculum of valued learning, taking into consideration also the aspirations and learning priorities of hapū (sub-tribes), iwi (tribes) and community' (Ministry of Education 2017). By this same notion, Te Whāriki includes a number of learning outcomes that align with teaching young tamariki about hazards and emergency management. Tamariki will develop:

- increasing knowledge about how to keep themselves safe from harm;
- a sense of responsibility for their own wellbeing and that of others;
- knowledge about the features of the area of significance to the local community;
- a sense of responsibility for the living world and knowledge about how to care for it; and,
- capacity for tolerating and enjoying a moderate degree of change, surprise, uncertainty and puzzlement

The following learning outcomes from Te Whāriki additionally support the development of resources based in reo Māori (Māori language), mātauranga (Māori knowledge) and tikanga (Māori cultural practices). Māori tamariki will develop:

- an appreciation of Te Reo Māori as a living and relevant language;
- familiarity with and enjoyment of stories and literature valued by the cultures represented in the community; and,
- familiarity with stories from different cultures about the natural, social, physical, spiritual and human-made worlds.

4.1 Background

As an oral culture, Māori conceived many solutions for passing on the multitude of knowledge they had acquired over time (Bishop 1996). Grounded in experience and knowledge, which often portrayed the relationships between atua (deities), the universe and humans in creative and engaging ways, pūrākau "reflect worldviews, preserved historical events, illuminated issues of the day and shared experience of the people and place" (Lee 2005). Creating a space for culturally responsive approaches to storytelling requires understanding that alternative forms of knowledge, such as Indigenous ways of knowing, also offers legitimate ways of talking, researching and representing narratives about our world. These stories become a pedagogical tool for learning about the past to inform the present, particularly through creating a sense of interconnectedness within whānau and their communities. A pūrākau approach to DRR communication enables Māori to express stories as an ethical, respectful, and meaningful approach that takes into account social, political and cultural concepts and values; these are reflected in both the process of information gathering and outcomes of research (Bishop 1996; Smith 1999).

4.2 Research Design

In order to ensure the second phase of developing a digitised version of the hardcopy pukapuka adhered to tikanga, our first step was to re-engage members of the initial working group if we were to take their original mahi (work/accomplishment) in this new direction. Most were excited to re-join the project and help steer it

in an appropriate direction, and those that were no longer able to be involved, kindly nominated other individuals to join the rōpū (group/committee). Our first (and all those thereafter) hui (gathering/meeting) was kanohi ki te kanohi (face-to-face) and focused on setting the kaupapa (purpose/values) for the mahi ahead of us. All members agreed that while we needed to be prepared for some changes that may eventuate with a digitised version, the same language, essence and mana (status/influence) should be kept in this next phase—it still needed to look and feel Ngāti Kahungunu at the end. Other values that were carried over into phase 2 of the project were:

- Adhere to tikanga and Mātauranga Māori
- Collaborate
- Keep it simple
- Make decisions by consensus
- Have input from kaumatua (elders)
- Build it alongside Kōhanga Reo
- Privilege Te Reo Māori and strive for excellence in language
- Bring about awareness and a greater discussion of risk and hazards to the rohe.

4.3 Activity Design and Implementation

Unlike printed texts, which offer the tactility of physically holding the pukapuka and flipping their pages, digital texts constrain readers to engaging with their story in a shallower, fast-moving, less-focused way (Mangen 2008; Campbell 2015; Sefton-Green et al., 2016). One solution to combat this is the manual dexterity of clicking a computer mouse, and other multimedia inputs such as animation or sound which allow greater interactive immersion than possible in a printed pukapuka.

In most cases the text and illustrations in the online pukapuka are the same as in the printed pukapuka, but enhanced by integrated multimedia features including animation, music and sound effects, and reading of the text out loud by a narrator. To ensure maximum engagement and knowledge transfer, the rōpū concluded that the addition of further narrative elements and learning opportunities via ‘hotspots’ would improve the online pukapuka. This would be a combination of other pūrākau (such as Moremore the shark) and emergency management planning information (such as how to evacuate in the event of a tsunami threat).

Additionally, our online pukapuka offers three options for engaging with the story. In the ‘Read’ mode, the visual presentation is a digital version of the printed pukapuka, with additional animation, music and sound effects, but no voice over narration or interactivity. In the ‘Read to Me’ mode, the pukapuka advances through the story automatically, with a voiceover narration of the text on each page, music, sound effects and animation. Following the voiceover narration of a double page spread, the ‘hotspots’ appear and interactivity is activated. In the ‘Watch’ mode, the pukapuka will play like a movie, with voiceover narration, music, sound effects and animation, but no interactivity option.

Currently, the programming is almost at its completion. Our next hui will be centred around planning how we might user-test the online pukapuka and consequently roll this out to tamariki within the rohe, as well as around the country. This will draw on the following research questions:

- • How are pūrākau used to pass down principles, values and beliefs to the next generation?
- • How does storytelling connect the past, present and future?
- • In what capacity does the platform encourage listeners to take responsibility for listening, interpreting, and reflecting upon the story?
- • Which medium has the greatest efficacy in knowledge transfer for tamariki?

5 KURA E TAI ĀNIWHANIHA- SCHOOLS AND TSUNAMI

Kia Takatū is a phrase in Māori that translates to “get ready” and is used by some civil defence agencies in their Māori language translation of materials for getting children prepared for disasters and natural hazards. Inspired by this call to action, researchers from the Joint Centre for Disaster Research (JCDR), Massey University and East Coast LAB (Life at the Boundary) in Napier in New Zealand were funded¹ to collaboratively develop and pilot a toolkit of earthquake and tsunami risk reduction activities with kura (schools) located in Hawke’s Bay tsunami evacuation zones. A Māori-led bicultural approach to developing and running the education activities was taken, focusing on creating culturally and locally relevant materials for students and schools, as well as giving students a proactive role in making their communities better prepared for a tsunami event. Lessons learned from this initial piloting have been used to develop phase two of the project which is focused on kura within Wellington tsunami evacuation zones.

Coastal areas of the Hawke’s Bay and Wellington regions have a long history of earthquakes such as the 1931 Napier Earthquake and more recently the 2016 Kaikōura earthquake. They have the potential to be strongly affected by future tsunami due to their proximity to the Hikurangi Subduction Zone. Because of the risk of near-source tsunami (which can reach land within minutes of any natural warnings) it is important that communities know what to do and where to go. The identification of the Hikurangi Subduction Zone as an area of international research importance has prompted new research activities in both the physical and social sciences (Wallace et al., 2016; Woods et al., 2017; Crawford et al., 2019). Within the social science perspective, little is currently known about community risk identification and preparedness behaviour in relation to seismic activity in the Hikurangi Subduction Zone. Historically, children have not been considered as a significant and proactive group for emergency preparedness messaging despite their value as information conduits within their families, and the importance of children knowing what to do in a crisis. It is therefore important that disaster preparedness holistically involves children to better empower them to become disaster-resilient and aware adults.

5.1 Background

It is widely acknowledged that schools play a crucial role in raising awareness of disasters, safety and risk among students, teachers, and parents (Shaw et al., 2004). Shiwaku (2009) suggests that the importance of disaster education at school is increasing because: (i) children are one of the most vulnerable sections of a society during a disaster; (ii) children represent future resilience; (iii) schools serve as communities’ central locations for meetings and group activities; and (iv) effects of education can be transferred to parents and the community (Shiwaku 2009). There are several studies in New Zealand that have recognised the value of hazards education programmes in schools, and the benefits for children who are repeatedly involved in hazard education activities (Ronan & Johnston 2001; Tarrant & Johnston 2010). King & Tarrant (2013) also suggest that there are numerous benefits of integrated school hazard education programmes. These include increased awareness of risks (Mitchell et al., 2008; Ronan & Johnston 2001) and motivating preparedness levels (Shaw et. al, 2004). Findings indicate that knowledge is a key aspect of positive coping, and can assist young people to understand the processes of a disaster and to feel less stressed and out of control following such events: “children’s knowledge of safe practices regarding earthquakes and tsunami was confirmed as a key aspect of their belief that they would be able to cope in the event of an earthquake” (King and Tarrant 2013: 24).

¹ This project has been supported with funding from the Resilience to Nature’s Challenges Mātauranga Māori theme and from QuakeCoRE (Centre of Research Excellence)

5.2 Research Design

This project 'Kura e Tai Āniwhaniwha' (Schools and Tsunami), is kāupapa Māori, Māori-centred research (created by Māori, for Māori, guided by Māori kaupapa-values) and is focused on the development of a kete (basket) of education activities that have been designed specifically for the schools we have worked with (Kaiser & Boersen, 2020). The aim of the research was to create activities that foster greater knowledge of earthquakes, tsunamis and what to do to stay safe in the event of a tsunami, and to utilise the tuakana/teina mentoring framework as a Te Ao Māori (a Māori worldview) mechanism for mentoring between students, as appropriate.

The research involves stakeholders from the JCDR, GNS Science, East Coast LAB and Te Whare Wānanga o Awanuiārangi, as well as local kura and bilingual schools. The end users consist of kaiako and tamariki. Data collection methods included hui, interviews and qualitative surveys, and a bricolage approach that drew from thematic and content analysis methods.

Initial hui were carried out with kaiako at the kura to determine what format and content would be most appropriate. Activities were designed and then carried out over a two-week period with a local high school. Cross-cohort mentorship is a pathway for educating children in a child-centric disaster risk reduction model. By following a tuakana/teina student mentorship model, students were able to take ownership of the resources they develop, and the responsibility of running the activities with younger students may help reinforce the importance of tsunami preparedness.

The high school students culminated the sessions by designing a series of fun and interactive activities focused on tsunami knowledge and preparedness to run with tamariki from a kura in the tsunami evacuation zone. Once the activities had been carried out, the researchers evaluated the process to find out what aspects of the process and activity worked, as well as identifying challenges in order to better inform the next iteration of the project.

5.3 Activity Design and Implementation

Before developing the kete of activities, we wanted to find out what would be most useful for the kura and school communities. To do this we held hui with kura and school staff to provide specific information about tsunami risk in their community, to shed light on what teachers already know about tsunami risk, and find out what activities and knowledge they would find most useful for their students. A focus group workshop with seventeen participants including school staff, kaiako, kohanga reo kaiako and whānau was carried out with guided group discussions on a series of thematic questions. Participants were also asked what activities their students found most engaging. A large range of activities were identified such as waiata (songs), drawing, creative writing, physical activities and art. We ensured to include a range of these in our activity design to reach a broad range of students. Below is a brief overview of the structure of the five sessions that were created:

- **Session 1:** Learning about tsunami: Introductions and initial student evaluation (what we know, what we want to know), information on what tsunamis are and how to prepare for them (presentation) Homework: creative writing activity
- **Session 2:** Learning about Māori Environmental Knowledge and the tsunami resilient kura framework (presentation), discuss different activities. Homework: form groups and come up with activity options
- **Session 3 & 4:** Designing a toolkit of activities in groups. Homework: complete an activity guide with step by step instructions to take to the kura
- **Session 5:** Run the activities with tamariki at the kura, conduct student self-evaluation

The high school students created a range of different activities to conduct with the students including; a tsunami rap song about preparedness that was taught to the whole group; scavenger hunts; a grab and go bag

activity where tamariki had to identify, in Māori, what items should and should not be in a grab and go bag; and an activity where the tamariki built structures from a range of materials and tested them in a simple tsunami simulator to see if they could withstand the inundation.

5.4 Evaluation

The final activity (Session 5) concluded with a short qualitative self-evaluation survey of the high school students who were asked: *what is something new you have learnt about tsunamis over the last five sessions?* (Answers included: going inland, if an earthquake is long, strong, get gone, and what to put in a grab and go bag). *What is something you have learnt while designing and carrying out your activity with the students?* (Answers included: how to work in groups, how to learn with kids, kids learn easier through hands-on activities, kids are really nice!). The final question they were asked was *what was your favourite part of the project?* (Students almost unanimously reported going to the school to teach the kids the activities was their favourite part). Providing a range of different learning approaches proved to be successful with the students, but it was the visit to the kura to run the activities themselves that really brought home the importance of teaching tamariki to be tsunami safe.

The findings from our research suggest that the programme was successful in increasing the knowledge of high school pupils on earthquake and tsunami preparedness as well as facilitating stronger connections between schools to collaborate on tsunami preparedness. Co-design with kaiako was an extremely important element of this research, as was maintaining a bi-cultural lens and framework for the activities. Working with high school students and fitting into the busy school schedule meant that we needed to be flexible and be prepared to change the structure of our sessions on the fly. It was also important to be conscious of the difference in the abilities of students in regards to Te Reo and Mātauranga Māori as well as our own limitations, particularly in regards to local tikanga and kawa (specific customs) of the schools, which the kaiako were happy to support us with.

6 COMMUNICATING HISTORIC AND CONTEMPORARY TSUNAMI RISK IN WHAREKAURI REKOHU- THE CHATHAM ISLANDS

The final project has woven local knowledge, Mātauranga Māori and western science to communicate historic and contemporary tsunami risk and resilience information using reciprocal and interactive public memorial events and hui in Wharekauri-Rekohu (the Chatham Islands).

6.1 Background

A MSc thesis by one of us (Thomas) at the University of Canterbury used participatory, community-based approaches alongside kaupapa Māori principles to investigate tsunami risk to her turangawaewae (place where one belongs and has rights to stand through kinship), Wharekauri (Thomas, 2018). Māori oral histories of past tsunami inundation were explored and used to inform a hazard scenario. Potential impacts to lifeline infrastructure networks were then assessed with local infrastructure managers and this information was used to co-create a list of potential actions during participatory community workshops that could be taken by the community to reduce future tsunami impact. The thesis is now complete (May 2017 – May 2018) and co-created valuable information for Chatham Islands iwi, Civil Defence and Emergency Management, emergency services, infrastructure managers, the fishing industry and households in exposed areas.

While members of the community were involved throughout the project and received the final report, further outreach was required to communicate the results in a suitable, culturally appropriate way (kanohi ki te kanohi). The 150th anniversary of the most destructive tsunami in recorded history on the Chatham Islands - the 1868 Arica tsunami - and development of new tsunami evacuation zones presented a timely opportunity

to communicate historic and contemporary tsunami risk and resilience information. A public memorial event was organised with local Civil Defence and Emergency Management and key iwi representatives held in August 2018 (Thomas et al., 2020). However, iwi trust representatives were unable to attend due to urgent Treaty of Waitangi negotiation matters. Therefore, a hui was organised for August 2019 when trust members were available.

6.2 Outreach design and activities

GNS Science, Geonet and the JCDR initially evaluated interest from Chatham Island Emergency Management, both Indigenous groups (Ngāti Mutunga o Wharekauri Iwi and Moriori) through their respective Iwi Trust Offices as well as other potentially interested community groups, schools and infrastructure companies. This engagement was led by author Kristie-Lee Thomas and Hamish Campbell who have pre-established relationships with the community. Interest in designing and organising the event was received from Chatham Islands Emergency Management and Ngāti Mutunga o Wharekauri Iwi Trust Manager. Two primary schools on Chatham Island, Kaingaroa School and Te One School were also interested. Other groups indicated they may attend. Phone calls and emails were then exchanged to design the activities and organise the event, and invitations were also extended to members of the science community invested in tsunami research on the Chatham Islands. The purpose of the memorial event was to:

- raise awareness of the fatal and destructive 1868 Arica tsunami, acknowledge and remember those who lost their lives and incurred losses from the tsunami; people on the Chatham Islands and the 25,000 who died in areas of southern Peru;
- raise awareness of potential tsunami sources for Aotearoa New Zealand and the Chatham Islands, tsunami processes and warning systems;
- raise awareness of potential impacts that may occur if a tsunami of similar magnitude were to hit the islands again and what the community can do to reduce the consequences (sharing results from recent research); and,
- encourage the community to be prepared for and resilient to the impacts of future tsunami.

Chatham and Pitt Islands have a combined population of approximately 600 people, of which, 59% identify as being Māori, with the remainder mostly identifying as being European or Pacific Islanders (Statistics New Zealand 2013). The known people who lost their lives in 1868 on the Chatham Islands were of Ngāti Mutunga decent (Thomas 2018). Therefore, it was vital that memorial activities were carried out in a culturally appropriate manner, abiding by Chatham Islands community tikanga and kawa. This was ensured by co-designing the memorial event with local and iwi representatives.

The anniversary was commemorated by travelling to Tupurangi, the site worst affected to acknowledge the impacts at this location and to say a karakia (prayer/blessing) for the lives lost there. This was followed by kai (food/nourishment), to abide by tikanga, followed by kōrero (discussion). Around 30 people attended. Māori oral histories shared by local kaumatua were re-told and information was shared on how the island may be impacted by a future tsunami, and what households could do to be prepared and reduce impact. This information resulted from participatory workshops with the community and interviews with local infrastructure managers during the thesis research. Copies of a story written for the Chatham Islander newspaper about the 1868 tsunami, postcards with key evacuation messages designed for the event and evacuation zone maps were distributed to attendees. Copies were also left at the hotel for local people and tourists. Kaingaroa School (less than 10 pupils) joined in with memorial activities. Te One School (approximately 50 students) preferred to be visited in the afternoon for a kōrero and activities including locating their homes on the evacuation maps, deciding what they would place in their grab and go bag, and simulating a long and strong earthquake and tsunami.

A hui was organised a year following the memorial event with Ngāti Mutunga o Wharekauri Iwi Trust to communicate the thesis results. The hui involved visiting wahi tapu (sacred sites, sites affected by the tsunami), karakia by kaumatua, kai at the marae (Māori meeting house), followed by kōrero about tsunami and discussion. The hui was advertised to the wider public through various local outlets. Nine people including the Ngāti Mutunga Trust General Manager, trustees and kaumatua attended the wahi tapu visit and 14 people attended the kai and kōrero. Information was well received with lots of discussion throughout the day, positive feedback and suggestions for community-led action. An idea was proposed to have an app created for the island displaying the evacuation zones and safe gathering places and emergency equipment, and potential funding avenues for this project were discussed.

6.3 Evaluation

Memorial events need to be co-designed with the community whose ancestors experienced the event and should be carried out in a culturally appropriate way respective of the local context (Thomas et al., 2020). The memorial event served as excellent outreach to promote tsunami awareness and preparedness for tamariki to kaumatua, and events were guided by the appropriate local kawa and tikanga of the community. There was a sense of collective ownership over the event and information shared about historic and contemporary tsunami risk. Intertwining Māori oral histories shared by kaumatua, local knowledge and scientific knowledge to communicate tsunami risk resulted in a high level of engagement, personalised the tsunami threat and encouraged ownership of the problem. With the passage of time and as generations pass, and people increasingly have no direct experience of disasters, the educative role of memorial events may be enhanced and provide opportunities for disaster preparedness engagement with communities. Many Chatham Islanders attended the memorial event and it was widely covered in the media through news articles, social media, magazines and newspapers. This showed the appetite of people to commemorate disaster anniversaries and indicates an educative function of memorials to share messages of preparedness.

7 COLLECTIVE DISCUSSION

The previous sections provided a summary of our three research projects and experiences in developing, implementing and reflecting on them. A number of themes emerged that warrant a collective discussion including the importance of maintaining a Te Ao Māori or bicultural lens, engagement, reciprocity and academic and cultural support.

7.1 Maintaining a Te Ao Māori or Bicultural Lens

As our collective mihi at the outset of this paper explored, we all have bi-cultural or multi-cultural heritage. Our experience as researchers is that Te Ao Māori and Te Ao Academia can be bifurcating worlds with entirely different process, kawa, tikanga and expectations that do not always harmoniously co-exist. In addition, the communities we engage with are culturally complex, so it is important to abide by local tikanga and kawa which may draw from Te Ao Maori, European or a multi-cultural heritage as well as He Awa Whiria (braided knowledge and methodologies) approaches (MacFarlane et al., 2018).

7.2 Engagement

Engagement activities with Māori communities (and communities in general) need to be adaptive and flexible to suit community needs and priorities. Community buy-in was a key requirement for ensuring the success of our projects. While Campbell and Kaiser were not members of the communities they were working with, they incorporated local stakeholders with mana (authority/influence) as key drivers within the research, and kaumatua who understood the local tikanga, kawa and Mātauranga Māori of their communities. Thomas on the other hand was an insider, but it was still extremely important to work with kaumatua and

local community members throughout the duration of the project to ensure the research was relevant and culturally appropriate. Incorporating community members as co-designers of the research was another important lesson for producing work that was useful, useable and used and aligned with community aspirations. Timing and repetition of engagement following completion should also be considered. An ongoing relationship with communities is important, and outsider researchers may not be able to continue engagement after the conclusion of the project due to funding, time and relationship constraints or geographical barriers.

7.3 Reciprocity

The three projects share novel approaches which supported the koha (gift) of knowledge between scientists, emergency management agencies and Māori and multicultural communities to increase resilience for Māori communities from tamariki to kaumatua. The projects were designed to adhere to community aspirations, address issues or information gaps that communities had, and to abide by local tikanga and kawa to ensure information shared during engagement was relevant and useful to participants, including preparedness information that was presented in local and relatable contexts applicable to each audience. Effective capacity-building occurred whereby the communities we engaged with were empowered using their own Mātauranga braided with recent research findings and preparedness information, and where we as emerging researchers learned useful lessons through co-designing activities and are able to share these lessons with others. The authors reflect upon the busy schedules of kaumatua, iwi representatives, school kaiako and community members, some who go beyond their responsibilities to invest time and energy engaging with researchers. As more Vision Mātauranga research projects arise across engineering and science disciplines we (all engineering and science researchers involved in Māori and community engagement) need to be mindful of the limited capacity communities have to engage with us, and to be wary of inducing engagement fatigue or disengagement.

7.4 Academic and Cultural Support

Receiving support from senior Māori and education researchers both formally and informally throughout our projects was extremely important for us as emerging researchers. We found tremendous value in the small but tight-knit network of emerging wāhine researchers and other Māori and Indigenous researchers who were able to find time to bounce ideas with us despite their very heavy workloads. Attending hui on marae to present research, as well as indigenous-specific conferences and workshops such as the Ngā Pae o Maramatanga and Pacific Risk Management Ohana Biennial hui, offer important opportunities for emerging researchers to share their findings with an indigenous audience, as do indigenous-specific panels at more general conferences and workshops. As Kahanomoku (2020) suggested, an indigenous research network with a focus on community research could exchange ideas that speak to specific complexities and challenges within their local communities and could also work to identify more general cross-cutting themes and practices and share some of the pedagogical and mentoring load for senior Indigenous researchers.

MSc and PhD theses are increasingly incorporating participatory, co-creation and/or kaupapa Māori research methodologies. This requires careful planning due to the time constraints of graduate projects often not allowing for in-depth engagement. It is also important that students receive cultural support and guidance to ensure results are shared in appropriate ways following completion. Thomas' project was possible due to support from QuakeCoRE, University of Canterbury, GNS Science and research supervisors which allowed for continued engagement and activities following thesis completion. However, other postgraduate projects may not receive the same support post-completion due to funding or availability of the student who may be employed soon after completion by non-research or overseas organisations, or due to the unavailability or non-suitability of supervisors to undertake the engagement on the student's behalf.

Insider researchers, particularly Māori who whakapapa (have Māori ancestry) to a particular rohe are extremely valuable for their local contextual knowledge and pre-established relationships and are often drawn upon for science engagement. While this presents a unique opportunity for the community to support their rangatahi/whanaunga (youth and family members) and to engage with someone they are likely to know and trust and for the insider researcher to contribute knowledge to their community; the mahi also involves unique challenges. Insider researchers who are permanently connected to the community (e.g. through whakapapa) carry reputational risk both personally and professionally if research is not undertaken and shared in an appropriate manner. Emerging researchers and students in these positions require appropriate cultural support from experienced academics or cultural advisors who have navigated similar situations and pressures.

8 CONCLUSION

From our collective experiences as early career Māori researchers and in light of the suggestions in the work of our Māori and indigenous colleagues we offer a number of initiatives for universities, research institutions and researchers to consider, for supporting a pathway to a strengthened, inclusive and diverse earthquake/tsunami resilience field:

- Better integration of Te Ao Māori in generalised studies at schools and universities - not just concentrated within Māori-specific programmes, schools and departments - and beyond matriculation events;
- Alongside Māori-specific schools and programmes, create nurturing and supportive environments that are co-designed by senior Māori teaching staff, emerging researchers and students to ensure emerging Māori researchers in the science and engineering disciplines can connect/reconnect with Te Ao Māori (including Te Reo and Tikanga wānanaga) if they choose to do so;
- Tuakana/Teina mentoring system where both the mentor and mentee are supported for time and resources (e.g. funds to travel to see mentor if mentors are not available locally);
- Resource the formation of Māori research support groups, across institutions (universities, CRI, private research) and disciplines where emerging Māori researchers can connect, share and support each other and make sure these are available to students. This would also support communication and coordination to prevent engagement fatigue in communities;
- Employ or contract certified Te Reo translators and Māori cultural advisors. These are significant jobs within themselves, and it is inappropriate to assume these are additional and unpaid responsibilities of emerging or established Māori academics to undertake or advise on;
- Resource opportunities for emerging Māori researchers, as well as iwi representatives/community members who make significant contributions to the research, to participate in international indigenous workshops and conferences to make more connections and present research to indigenous audiences; and,
- Initiate an international working group or network of Indigenous practitioners and educators familiar with both the specifics of their disciplines and best practices in Indigenous pedagogies and student mentorship.

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GLOSSARY

Te Reo Māori	English (Moorfield, 2020)
Atua	Ancestor with continuing influence over particular domains. Many Māori trace their ancestry from <i>atua</i> in their <i>whakapapa</i> . These <i>atua</i> also were a way of rationalising and perceiving the world. Normally invisible, <i>atua</i> may have visible representations.
Hapū	Sub-tribe
Hīkoi	To walk, trek, journey.
Hui	To gather, congregate, assemble, meet
Iwi	Tribe
Kaumatua	Elders - a person of status within the whānau
Kai	Food, to share a meal, nourishment
Kaiako	Teachers
Kanohi ki te kanohi	Face to face, in person
Karakia	To recite ritual chants, say grace, pray, say a blessing.
Kaupapa	Topic, policy, purpose, matter for discussion.
Kaupapa Māori	A Māori philosophical doctrine, incorporating the knowledge, skills, attitudes and values of Māori society.”

Kawa	Specific customs for the opening of new houses, canoes and other events.
Kete	Basket, kit
Kia Takatū	to prepare, get ready (people)
Koha	Gift/contribution
Kōhanga Reo	Māori language early childhood education centres
Kōrero	Discussion
Kura	School
Mahi	work, accomplish, practise
Mana	Prestige, authority, influence, status
Māori	The Indigenous people of Aotearoa New Zealand
Marae	Māori meeting house
Mātauranga Māori	Māori knowledge - the body of knowledge originating from Māori ancestors, including the Māori world view and perspectives.
Mihi	To greet, pay tribute, acknowledge, thank.
Parawhenua	The personified form of the waters of earth, associated with tsunami
Pukapuka	Book
Pūrākau	Cultural stories passed down through ancestral lines
Rangatahi	younger generation, youth
Rūaumoko	A Māori ancestor with influence over earthquake, volcanic and geothermal activity
Rohe	Area of land, boundary, territory,
Rōpū	Group/committee

Tamariki	Children
Tangata Whenua	“Indigenous people - born where the ancestors have lived and where their placenta are buried.”
Te Ao Māori	A Māori worldview
Te Reo Māori	Māori language
Tēina	Younger brother/sister
Te Whare Tapa Wha	One model for understanding Māori health (Durie 1984)
Tikanga	Customary protocols - “the customary system of values and practices that have developed over time and are deeply embedded in the social context”
Tuākana	Elder brother/sister
Wāhine	Women
Wāhi Tapu	A sacred place
Waiata	Song
Whakaaro	Thought, understanding, idea, opinion,
Whakapapa	Genealogy, lineage, descent
Whānau	Extended family
Whanaunga	Blood relation, kin
Wharekauri-Rekohu	The Chatham Islands